

# Goddard Space Flight Center

## Challenges in a Changing Environment: Insights from NASA's Goddard Space Flight Center

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Chief Financial Officer

Presentation to the Project Management Symposium  
Project Management Center for Excellence  
University of Maryland

May 4, 2017





- Goddard Overview
- Project Management Leadership Considerations
- Lessons Learned
- Changing Environment for Projects
- GSFC Business Change Initiative
- Principles of Change



# Goddard Overview



# Where We Are Located

**ONE** World-Class Science and Engineering Organization

**FIVE** Distinctive Facilities & Installations

**Greenbelt  
Main Campus**  
1,270 Acres

Executing NASA's  
Most Complex  
Science Missions  
Est. 1959



**MARYLAND**

**Wallops Flight  
Facility**  
6,188 Acres

Launching Payloads  
for NASA and the  
Nation  
Est. 1945



**VIRGINIA**

**Goddard  
Institute for  
Space Studies**

Understanding  
Our  
Planet  
Est. 1961



**NEW YORK**

**Independent  
Validation &  
Verification Facility**

Providing  
Software  
Assurance  
Est. 1993



**WEST VIRGINIA**

**White Sands Test  
Facility Ground  
Station**

Communicating  
with Assets in  
Earth's Orbit  
Est. 1963



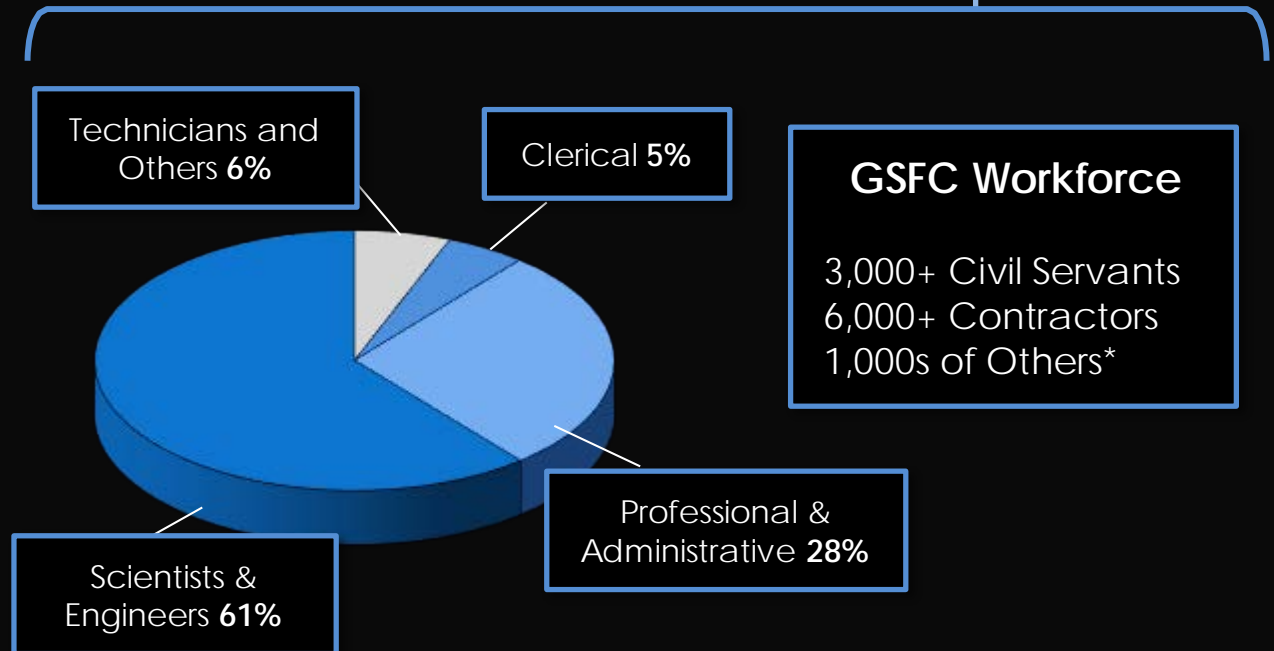
**NEW MEXICO**

# Who We Are



## THE GODDARD COMMUNITY

More than 10,000 People



The Nation's largest community of  
**scientists, engineers, and technologists**

# Goddard Space Flight Center

## *Employees Receive Worldwide Accolades for Their Work*

**Dr. Piers Sellers**  
Most Excellent Order of  
the British Empire  
2011



**Dr. John Mather**  
Nobel Prize in Physics – 2006  
Rumford Prize – 1996  
Franklin Medal – 1999



Dr. Mather is the recipient of more than 30 honors in the physical sciences.

**Dr. Compton Tucker**  
Galathea Medal – Denmark 2004  
Vega Medal – Sweden 2014  
In Physical Geography



The Intergovernmental Panel on Climate Change (IPCC) was awarded the Nobel Peace Prize in 2007 for its work on climate change, together with former US Vice-President Al Gore. Over 50 scientists from the Goddard Space Flight Center contributed to the IPCC Assessments that formed the basis for the award.



# Our Science



## EARTH SCIENCES

- How does the Earth – atmosphere, ice, oceans, land, humans – work?
- How do we humans impact the climate?
- How will the Earth's climate evolve in the future?

## HELIOPHYSICS

- How does the sun work?
- When does space harm us?
- How to live within a star's atmosphere?

## ASTROPHYSICS

- How does the universe work?
- Where did we come from?
- Are we alone?

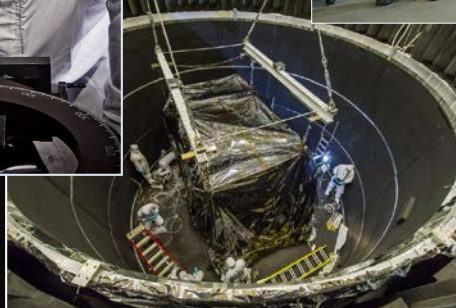
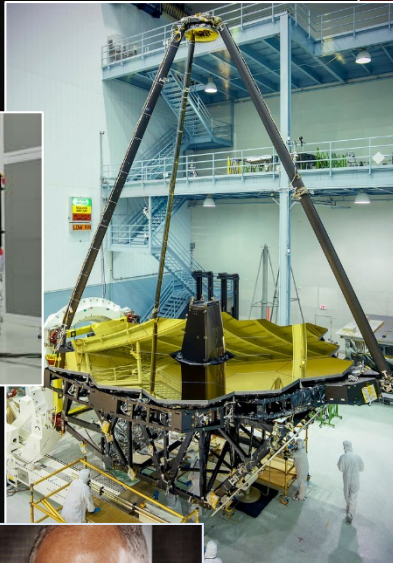
## SOLAR SYSTEM

- How did our solar system form and evolve?
- Can we find evidence of life elsewhere in the solar system?
- What are the different environments and processes in our solar system?

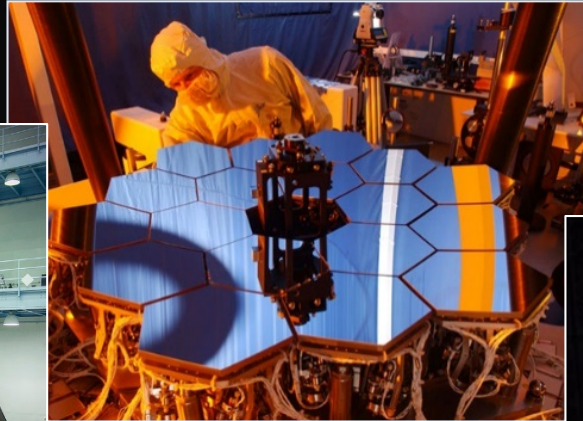
# Our Capabilities



## World Class Facilities



## Engineering and Technology Development



## End-to-End Capabilities from Concept through End of Mission Life



## Exceptional Human Capital



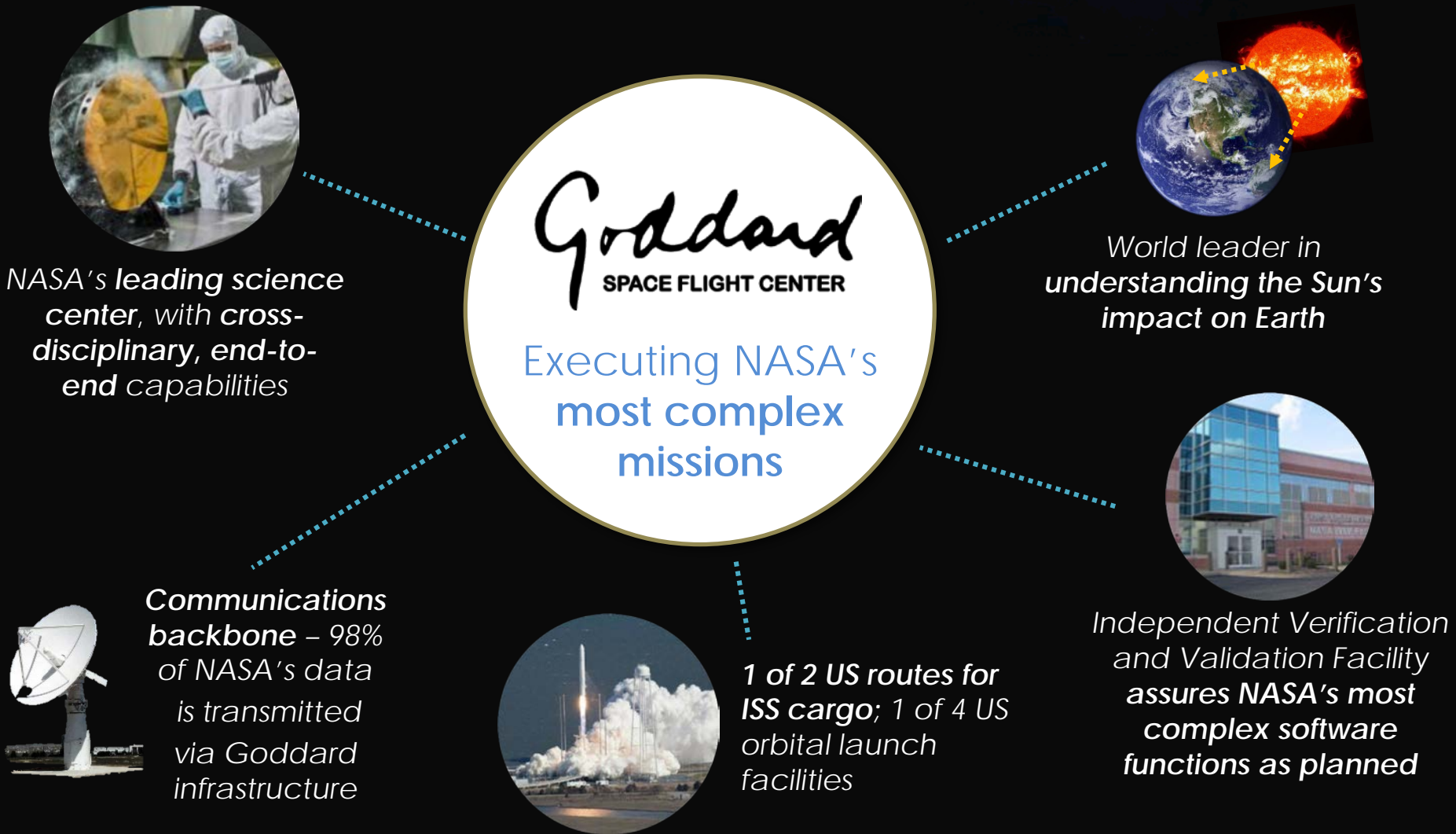
## Expertise in Core Science and Cross-Cutting Disciplines



## Diverse Partnerships

# One World-Class Organization

*What makes Goddard one-of-a-kind?*





*Ranked No. 1*

Within NASA

**Best**  
Place  
to  
Work"

# GSFC: A Diverse Mission Portfolio

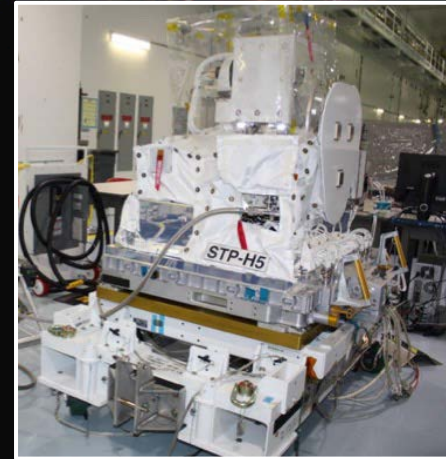


# Recent Launches



**Origins, Spectral Interpretation, Resource Identification, Security-Regolith Explorer (OSIRIS-REx)** is an asteroid sample return mission to near Earth asteroid Bennu with sample return to Earth in 9/2023.

**Geostationary Operational Environmental Satellite-R (GOES-R)** is a collaborative program between NOAA & NASA to develop the next generation GOES environmental satellites.



**Raven** launches to International Space Station as a test bed to demonstrate new real time, relative navigation technologies.



# Upcoming Launches in 2017

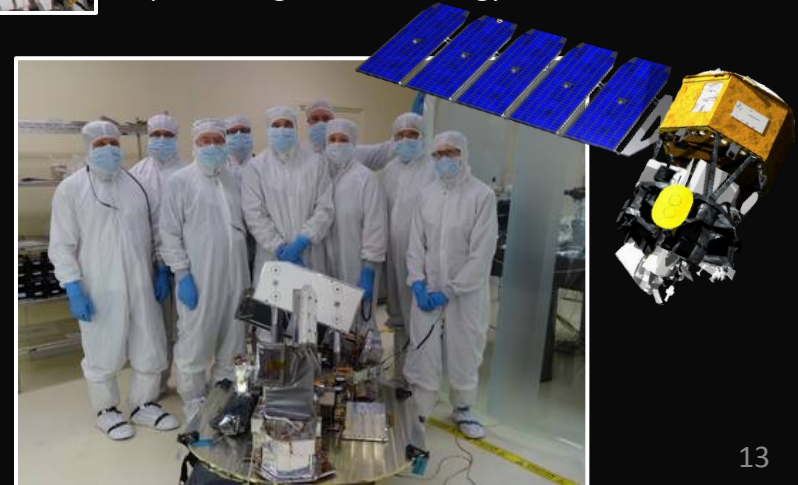


**Joint Polar Satellite System-1 (JPSS-1)** spacecraft will sustain continuity of and enhance NOAA's Earth observation analysis and forecasting capabilities from global polar-orbiting observations.

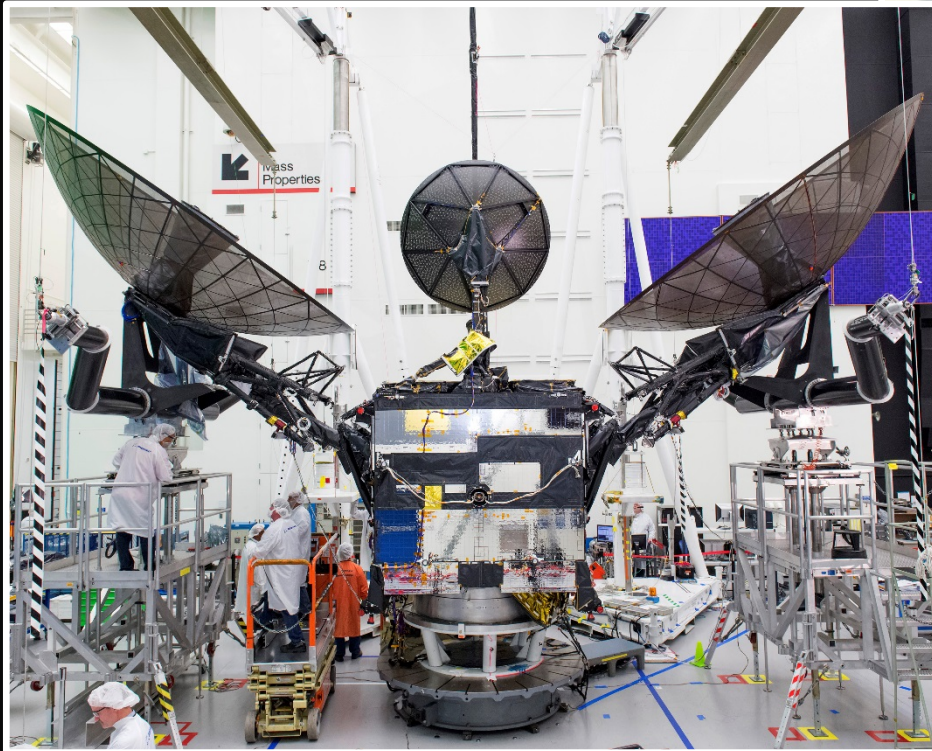
**Ionospheric Connection Explorer (ICON)** will investigate the forces at play in the near-space environment, leading the way in understanding disturbances that can lead to severe interference with communications and GPS signals.



**Neutron star Interior Composition Explorer (NICER)** astrophysics mission will uncover the physics governing the ultra-dense interiors of neutron stars. Using the same platform, the mission will demonstrate trailblazing space navigation technology.

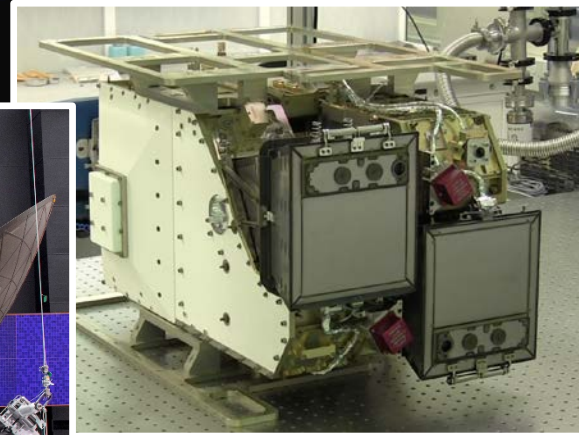


# Upcoming Launches in 2017



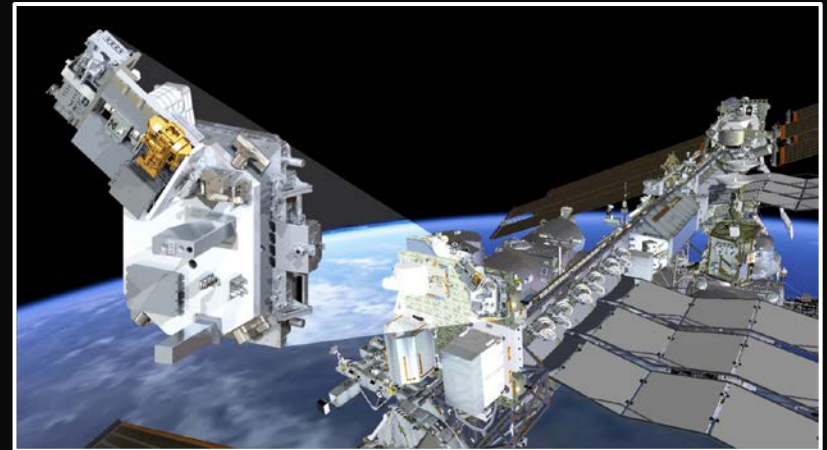
## **Tracking and Data Relay Satellite-M (TDRS-M)**

is the third satellite in a series that will ensure the Space Network's continuation of around-the-clock, high throughput communications services to NASA's missions.



## **Global-scale Observations of the Limb and Disk (GOLD)**

will examine the response of the upper atmosphere to forcing from the Sun, the magnetosphere and the lower atmosphere.



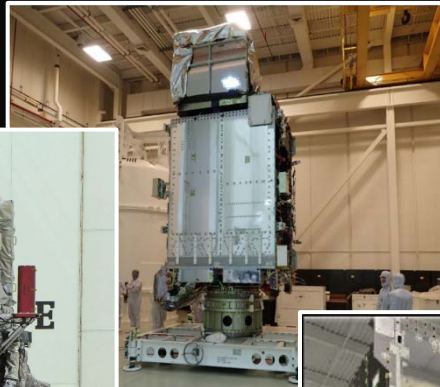
## **Total and Spectral Solar Irradiance Sensor (TSIS-1)**

mission will provide absolute measurements of the total solar irradiance (TSI) and spectral solar irradiance (SSI), important for accurate scientific models of climate change and solar variability

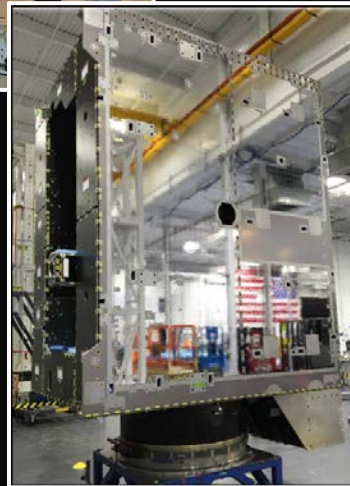
# Joint Agency Programs



GOES-R at KSC



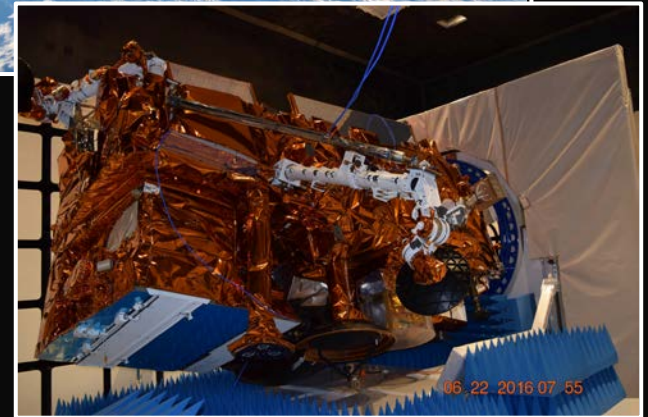
GOES-S



GOES-T system module



JPSS-2 Satellite



JPSS-1 Satellite in EMI testing on June 22, 2016

**Geostationary Operational Environmental Satellite-R Series (GOES-R)** is the next generation of NOAA's GOES satellites that will provide a major improvement in quality, quantity, and timeliness of data collected. The GOES-R Series will provide improved detection and observations of meteorological phenomena that directly impact public safety, protection of property, and economic health and development. The series consists of 4 satellites: GOES-R, GOES-S, GOES-T, and GOES-U.

**Joint Polar Satellite System (JPSS)** Program provides operational continuity of satellite-based observations and ground segment data products for NOAA Polar-orbiting Operational Environmental Satellites (POES) and the Suomi National Polar-orbiting Partnership (SNPP). JPSS consists of a series of polar-orbiting environmental satellites: JPSS-1, JPSS-2, JPSS-3, and JPSS-4.


# Planetary Science: Decoding the Solar System

Goddard's **unique instrument capabilities** are key in determining the content, origin, and evolution of the planets in our solar system & in enabling deeper space exploration



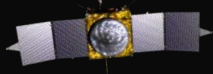
## ENABLING EXPLORATION

Goddard has the most **planetary science instruments** in the World, and our planetary missions are providing a deep understanding of the solar system



**Lunar Reconnaissance Orbiter (LRO)** is mapping the Moon, characterizing its radiation environment, and determining the availability of key resources – all key to future human exploration

**Origins, Spectral Interpretation, Resource Identification, Security-Regolith Explorer (OSIRIS-REx)** (launched in 2016) is en route to Bennu and will conduct the first ever asteroid sample return and will demonstrate capabilities critical to in-situ resource utilization



**Mars Atmosphere and Volatile Evolution Mission (MAVEN)** is orbiting Mars, assessing the evolution of its atmosphere; **Sample Analysis at Mars (SAM)** is the heart of NASA's Curiosity rover and the most capable chemistry lab to have landed on Mars



MOON



ASTEROIDS



MARS



# Heliophysics: Exploring the Earth-Sun Connection

Goddard is leading research on the Sun and its interactions with Earth to help monitor space weather and **protect U.S. power grids and critical infrastructure**




## WORLD'S LARGEST

collection of heliophysicists

**Magnetic Multiscale (MMS)** mission investigates how the Sun's and Earth's magnetic fields reconnect, enabling us to better understand how geospace weather affects modern telecommunications networks, GPS navigation, and electrical power grids

**The Solar Dynamics Observatory (SDO)** observes the Sun's influence on Earth and how space weather is created by solar activity – **100 million** images of the sun were taken between 2010 and 2015



**Discovered: Solar Flares From 80,000-Mile Wide Sunspot Threaten Earth**

- Oct. 24, 2015

# UNDERSTANDING THE SUN

to protect Earth & enable deep space exploration



# Earth Science: Understanding Earth as a System

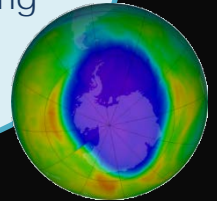
Through **advanced instrumentation, science, and project management expertise**, Goddard plays a critical role in improving and protecting life on the home planet

Goddard is NASA's hub for the **monitoring and modeling of Earth's complex systems**; since 1997 NASA's EOS satellites have collected long-term global measurements from space to better understand our complex Earth and improve life on the home planet  
**water | weather | atmosphere | natural hazards**

30+ YEARS OF EARTH OBSERVATIONS

**EOS**

Earth Observing System



**NASA Releases First Global Rainfall and Snowfall Map**

– Feb 26, 2015



NASA's **Global Precipitation Measurement (GPM)** mission is providing a global map of rain and snowfall, helping to **monitor hurricanes in real time** and **improve our understanding and forecasting of extreme weather, the spread of water-borne diseases, crop yields, and freshwater availability**

**IMPROVING** our understanding and protection

of the home planet





# Astrophysics: Unlocking the Secrets of our Universe

From **flagships to explorers**, spanning **astronomical domains**, Goddard is uniquely qualified to discover how the universe works and to search for extrasolar life

**Dark energy**

**Exploding stars**

**Extrasolar worlds**

**The age of the Universe...**

Hubble Space Telescope's return on investment has been priceless, with twenty-five years of extraordinary imagery and data helping us **solve some of astronomy's most pressing questions** and giving rise to **many new mysteries**

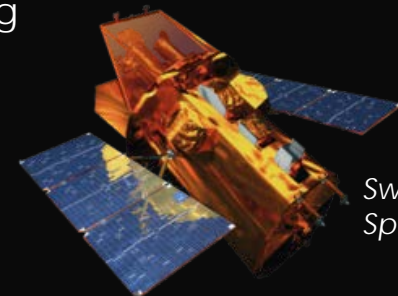


*Hubble Telescope at 25 –  
Hubble's Greatest Hits*  
– April 2015, National Geographic  
Magazine

## EXPLORING DEEPER THAN WE EVER HAVE BEFORE

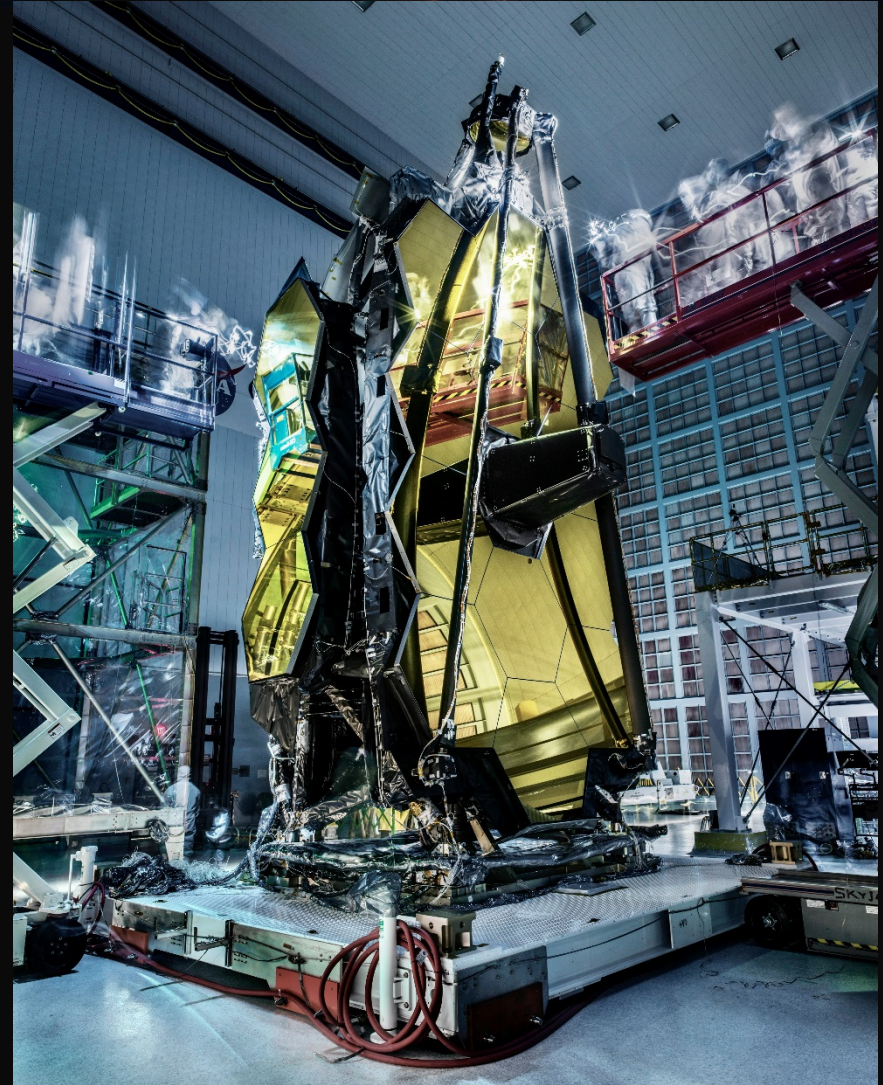
**Forget Interstellar,  
Watch Milestones  
from NASA Swift's  
10 Years in Space**  
– Nov 30, 2014

**Swift** has marked 10 years of game-changing astrophysics, and remains **the only satellite capable of precisely locating the universe's most powerful explosions** and monitoring them before they fade from view



Swift  
Spacecraft

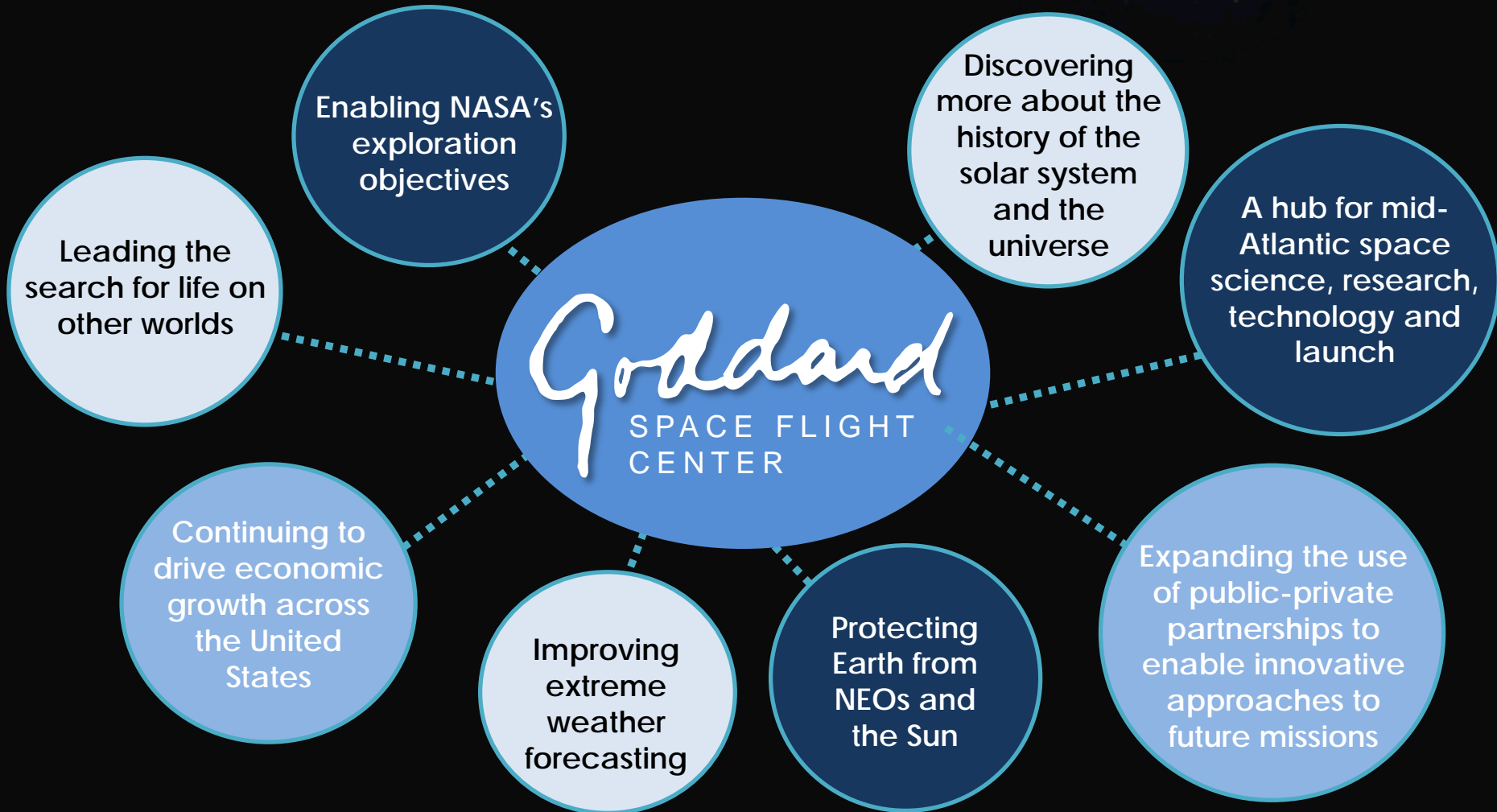
# James Webb Space Telescope Progress



<https://youtu.be/r1ybe4yr2no?t=58>

# Vision for the Future

20 years from now, Goddard will be...



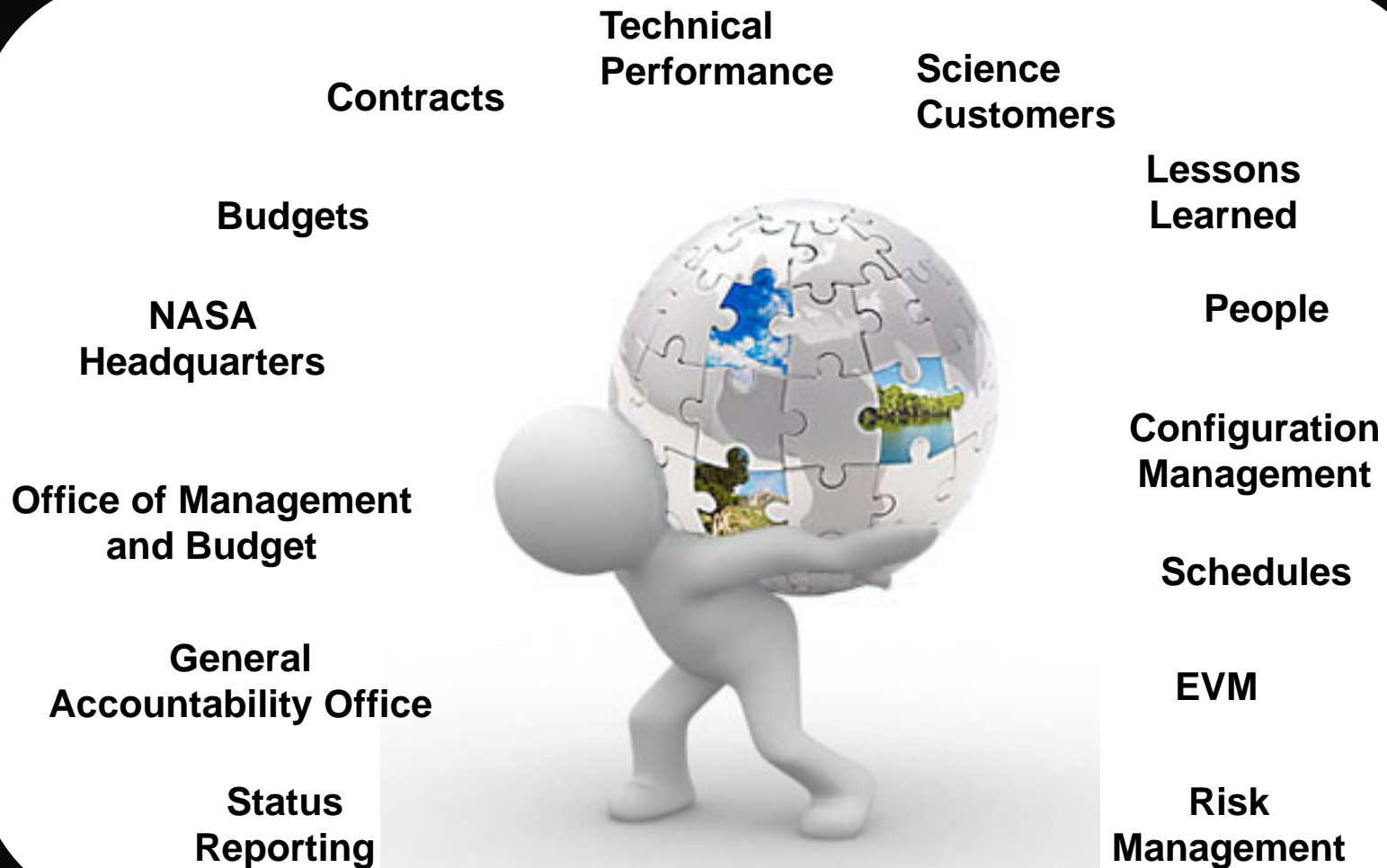
## MAKING THE WORLD A BETTER PLACE



# Project Management Leadership Considerations

# What does a Project Manager Do?

Planning, Organization, Implementation, and Control





# Project Management: Principles to Success

## 1. *Establish a clear and compelling vision*

- Create a clearly defined vision of the future that serves to inspire and motivate the project team which in turn provides an important first step in paving the road toward project success

## 2. *Secure sustained support “from the top”*

- Develop effective working relationships with key stakeholders at all levels

## 3. *Exercise strong leadership and management*

- Identify and develop other leaders and technical staff within the organization, define clear lines of authority and demand accountability

## 4. *Facilitate wide open communication*

- Listen and share the good, the bad and the ugly

## 5. *Develop a strong organization*

- Design and align culture, rewards, and structure

## 6. *Manage risk/seek opportunities*

- Employ a continuous and evolving risk-management process
- Look forward then exploit opportunities to reduce cost or schedule requirements through agile principles

## 7. *Establish, maintain, and implement an executable baseline*

- Develop clear, stable objectives/requirements from the outset; establish clean interfaces; track changes, implement corrective actions when necessary; and maintain effective configuration control



# Unique Challenges for Project Management

- Problems and challenges arise even on the most well planned projects
- Need both schedule and budget reserve to address unknown unknowns
  - Need reserves to actively manage issues and concerns to minimize cost and schedule impacts
  - Need reserves to mitigate risks
- Need to manage technical reserves and design margins
  - Exceeding technical reserves and design margins may force re-designs, affect mission performance requirements, and/or deplete cost and schedule reserves

# Challenges – Schedule

- Meeting planetary windows brings hard deadlines
  - May need to wait months or years for next launch opportunity



OSIRIS-REx completing environmental testing  
Launch window September 3 – October 12, 2016

# Challenges – Changing Requirements



- There will be reasons to change requirements after they are baselined — budget cuts, changes in funding profiles, system upgrades, unplanned changes in an interface, or changes in a regulation or a standard, etc.
- Requirements creep, both in the science and engineering areas must be minimized to stay on schedule and within budget

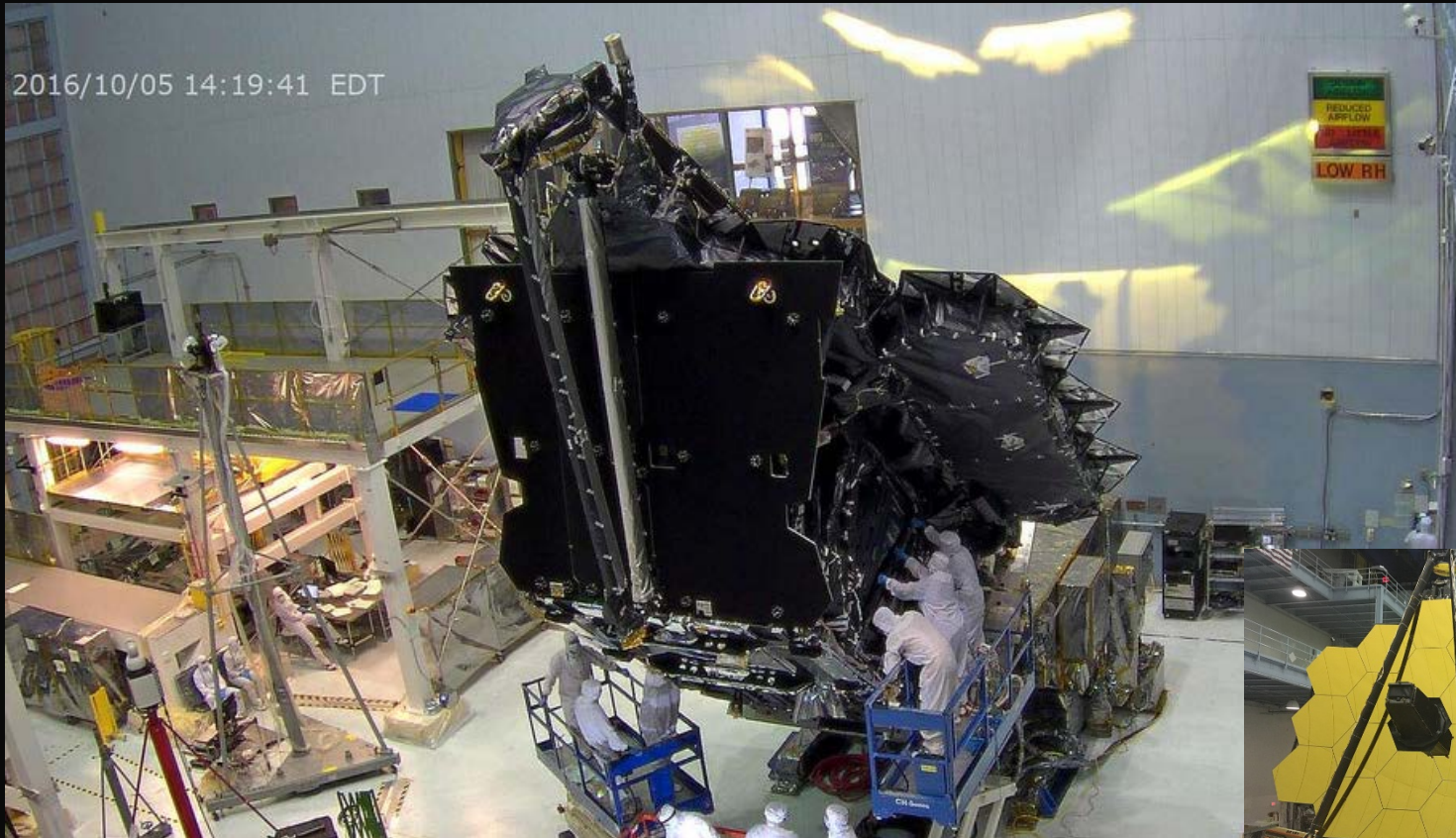


Landsat Data Continuity Mission (LDCM) - The Thermal Infrared Sensor (TIRS) instrument drove schedule



# Challenge – Complex Design (1 of 2)

- Satellites with complex designs and/or large scale pose unique challenges
  - Drives schedule and cost



James Webb Space Telescope (JWST)



# Challenge – Complex Design (2 of 2)

- Satellites with complex designs may need unique or one-of-a-kind facilities and support equipment
- Ground systems can also have complex designs and/or unique challenges



New vibration facility for JWST

April 2016



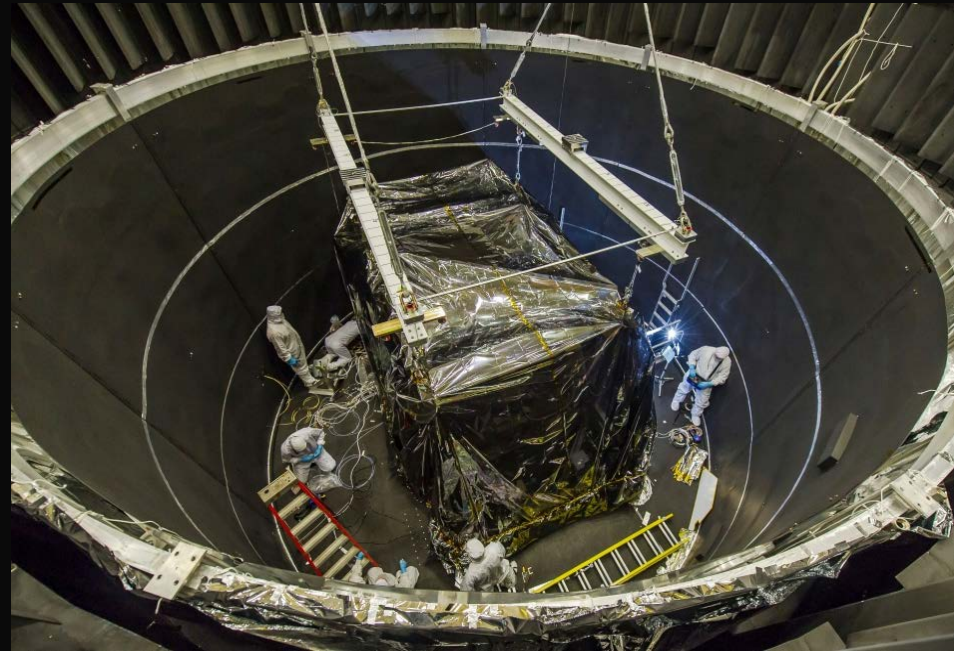
JWST thermal vacuum testing to occur at Johnson Space Center

# Challenges – Facility Conflicts

- Schedule conflicts between projects using integration and test facilities
  - May require building new facilities
  - May require taking hardware to outside facilities



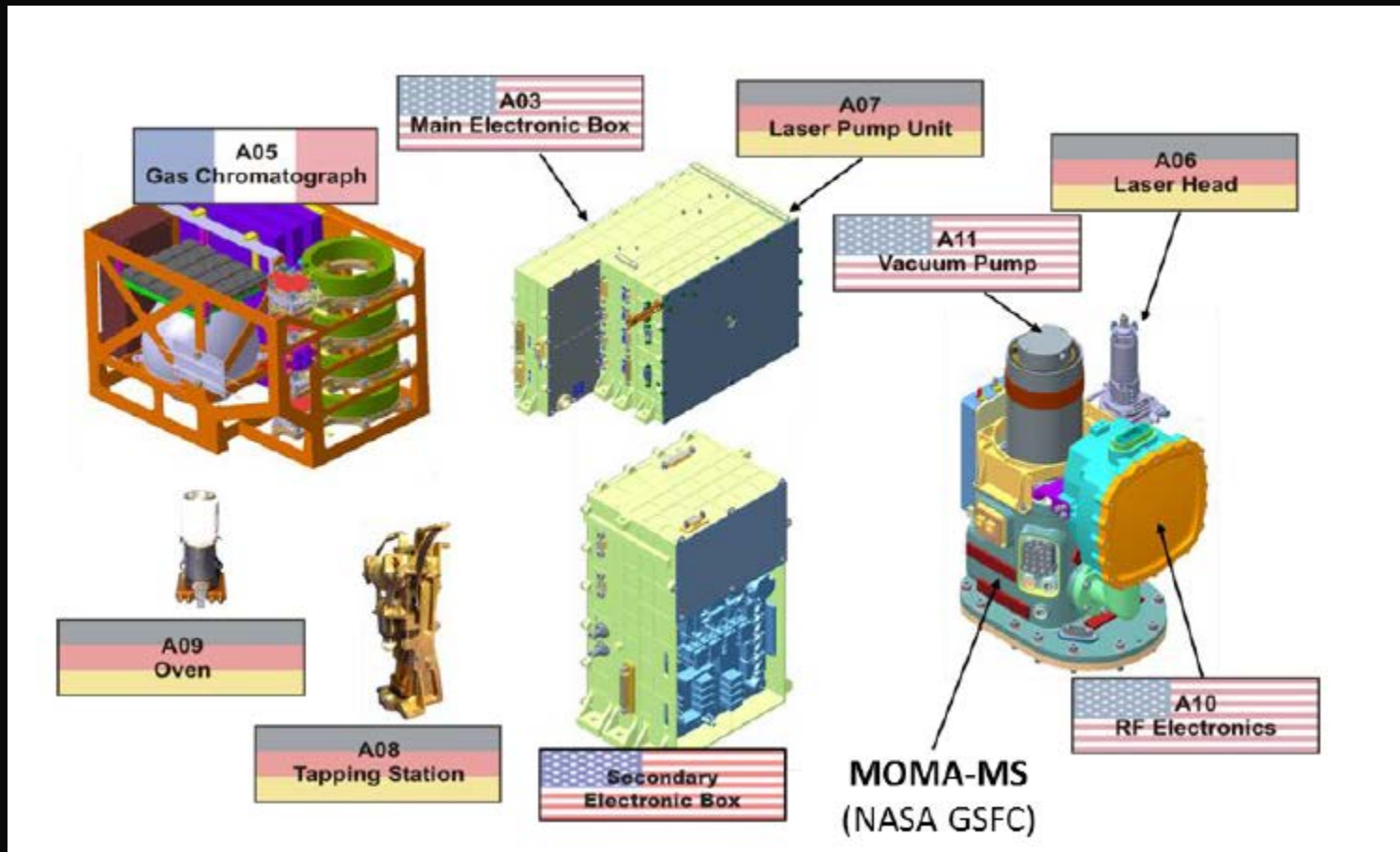
- MMS conflict with JWST required MMS to go to Naval Research Laboratory for thermal vacuum testing
- Facility conflicts also drove MMS to build their own cleanroom facility



- JWST Integrated Science Instrument Module being lowered into the GSFC Space Environment Simulator Thermal Vacuum chamber

# Challenges – Outside Partnerships

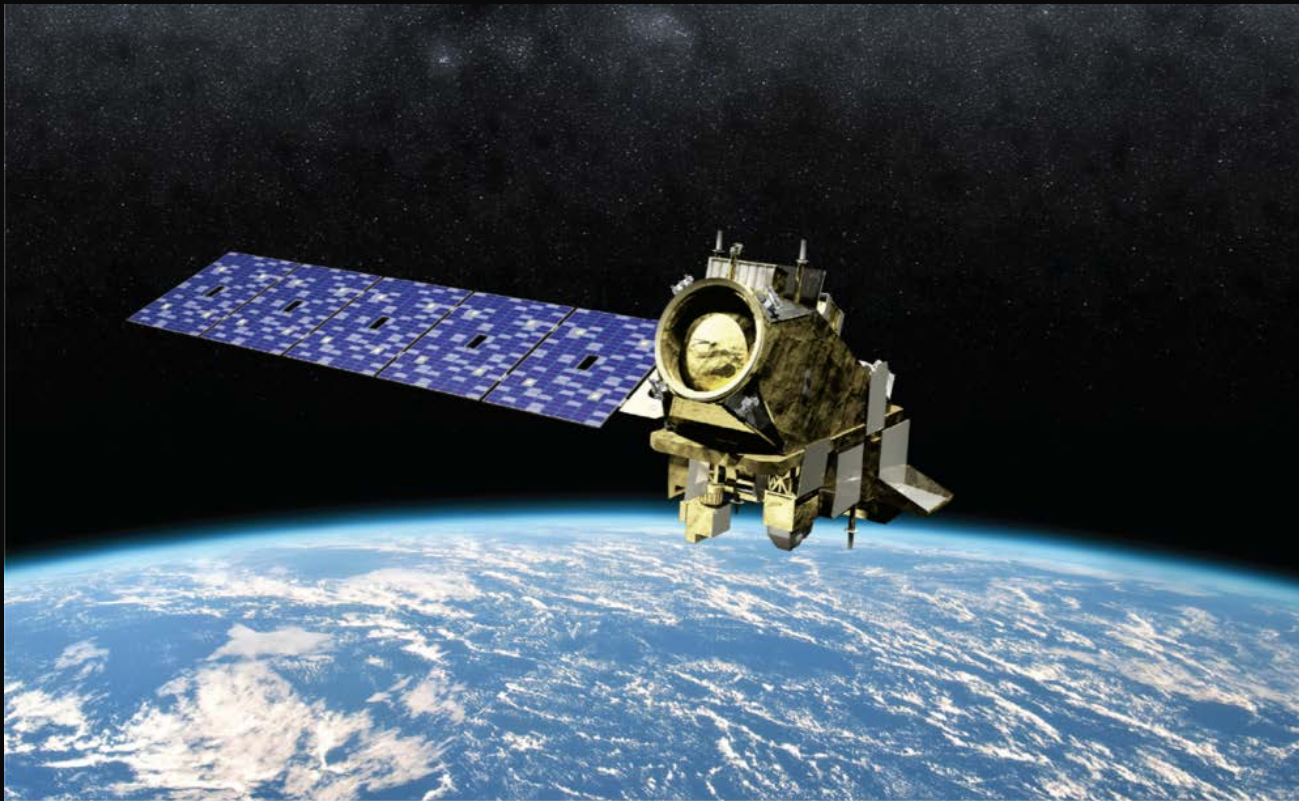
- Partnerships with outside organizations can drive funding and schedule beyond the control of the GSFC project manager
- Partners can also back out of agreements



GSFC contribution to European ExoMars mission: Mars Organic Molecule Analyzer Mass Spectrometer (MOMA-MS)

# Challenges – Procurement Delays

- Delays in awarding procurements can increase cost, as well as decrease schedule margins



JPSS-2, -3, and -4 spacecraft experienced a delayed start as a result of a procurement protest

# Challenges – Hardware Issues

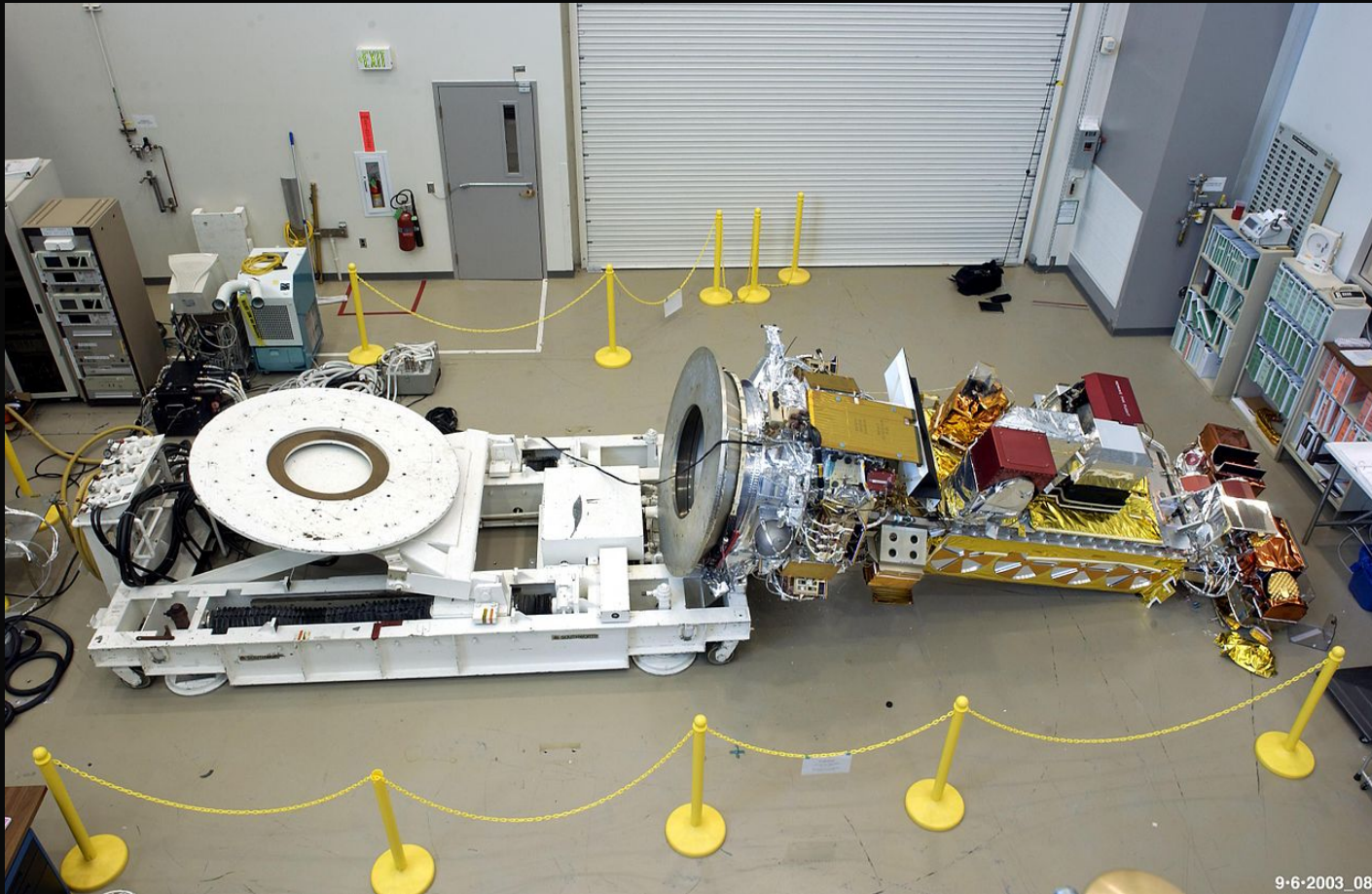
- Hardware issues can cause cost increases, schedule delays, re-designs, and re-plans
  - Parts issues
    - Parts not available
    - Long lead items do *not* meet mission schedule
    - Parts may require test program
  - Hardware issues
    - Poor workmanship
    - Failure during testing
    - Behind schedule
    - Exceeded budget
    - Unexplained test results
    - Late deliveries



Late hardware deliveries from suppliers

# Challenges – Mishaps

- Major unplanned events often require a project “stand-down” and re-plan



Spacecraft mishap during integration

# Challenges – Launch Vehicle Schedule

- Delays in launch vehicle schedules use up funding and schedule reserves
- Project manager needs to incorporate schedule and cost margin in budget for normal launch delays of a few weeks or months
  - May need to re-plan and request more funding from Headquarters for longer delays
- Launch vehicle failures tend to cause long launch delays, as well as, backlogs in the manifest



MAVEN Launch on ATLAS V on  
November 18, 2013



DSCOVR launch on Falcon 9 rocket from  
Kennedy Space Center on February 11, 2015

# Challenges – On Orbit Events

- Orbital events can cause a loss of mission
- STEREO mission experienced problems in October 2014
  - Lost communications with one of the two spacecraft while in extended operations
- Defense Meteorological Satellite Program (DMSP 19) broke up in orbit in February 2015
  - Exploded while in a Sun-synchronous polar orbit leaving a large debris field
- Micrometeoroid impact to the MMS 4 spacecraft but all instruments and the spacecraft are still functioning
- NASA monitors space debris and performs collision risk conjunction assessments (CARA)
  - Routinely needs to move satellites to avoid collisions



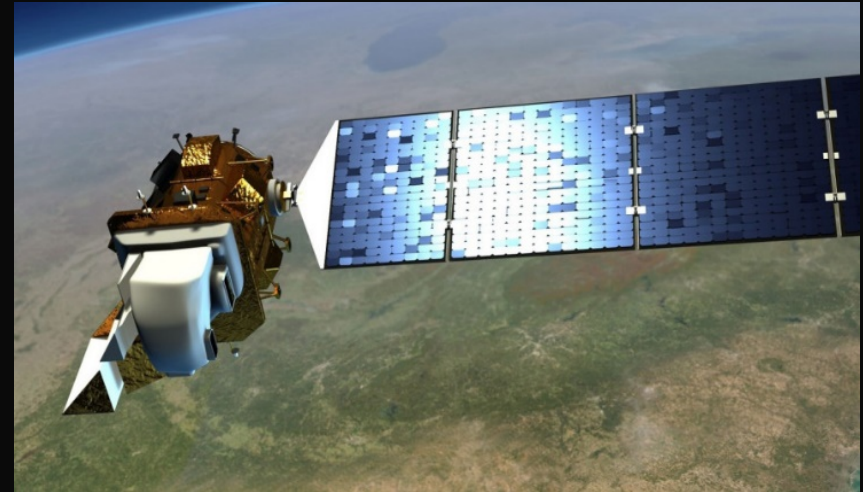
STEREO Satellites during Spin Test

# Challenges – Stakeholders

- Key stakeholders often drive launch dates and funding, as well as ownership of mission between agencies
- Stakeholders include Congress, Office of Management and Budget, science communities, and other agencies
- Outcomes are often out of the control of the Center and project manager



Deep Space Climate Observatory



Landsat 9: Stakeholders driving launch readiness date

Triana mission originally scheduled to launch in 2003 (NASA mission)

Storage from 2001 to 2013

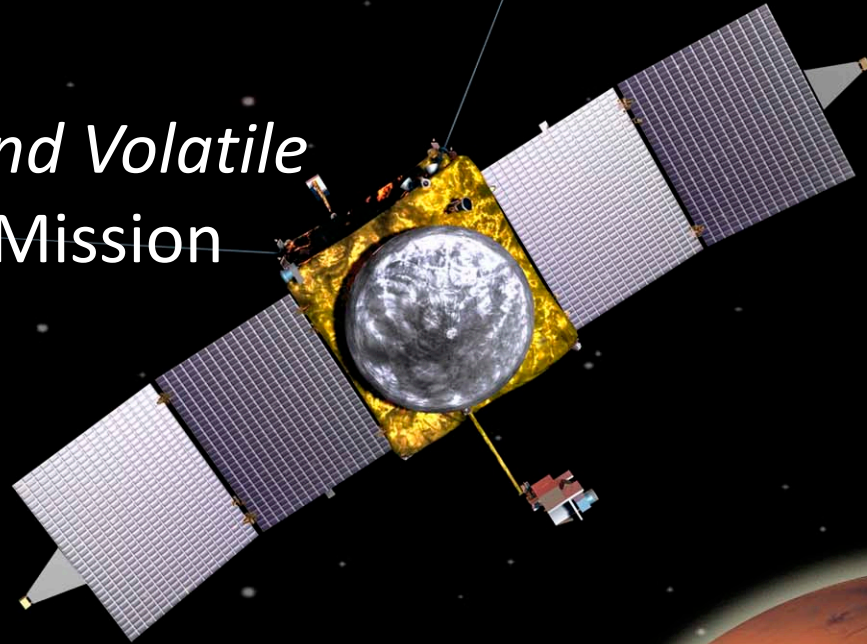
Several attempts to revive mission

DSCOVR mission (formerly Triana) confirmation in 2013 with launch in 2015 (joint NASA/NOAA mission)

Same instruments/measurements – different prime mission focus (earth science to solar storm warning)



*Mars Atmosphere and Volatile  
Evolution (MAVEN) Mission*



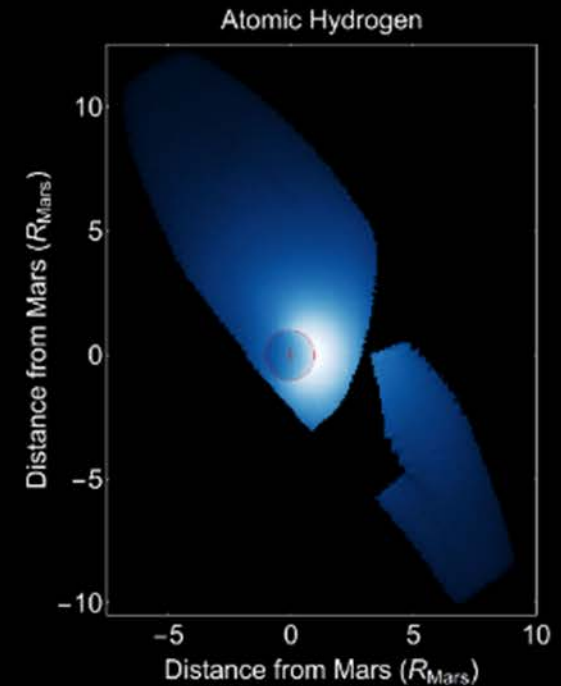
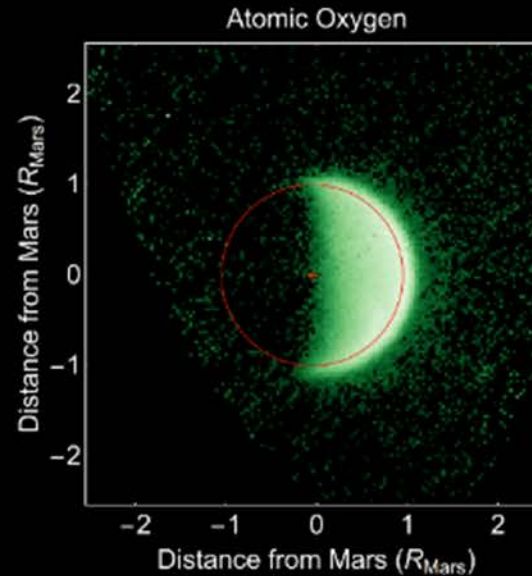
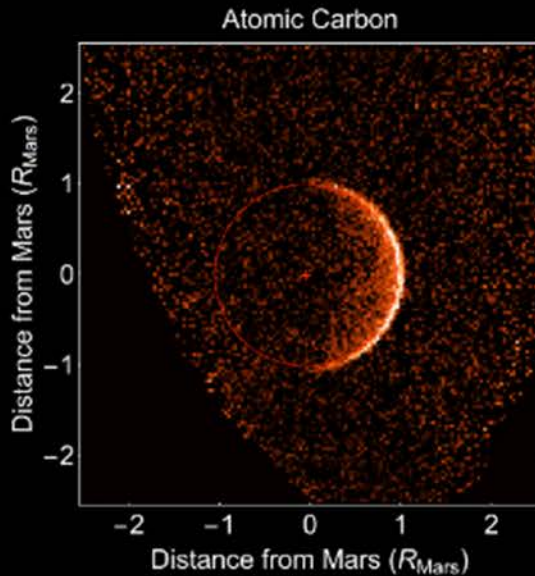
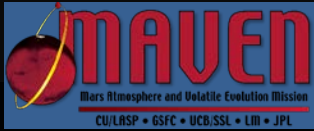
# The MAVEN Experience

...a Team Effort





# Payoff - MAVEN Observations at Mars



## Three views of an escaping atmosphere

- Shows H, C, and O that are participating in processes leading to loss to space
- Allows us to track loss of climate-related gases  $\text{H}_2\text{O}$  and  $\text{CO}_2$



# Lessons Learned



# Lessons Learned from the MAVEN Journey

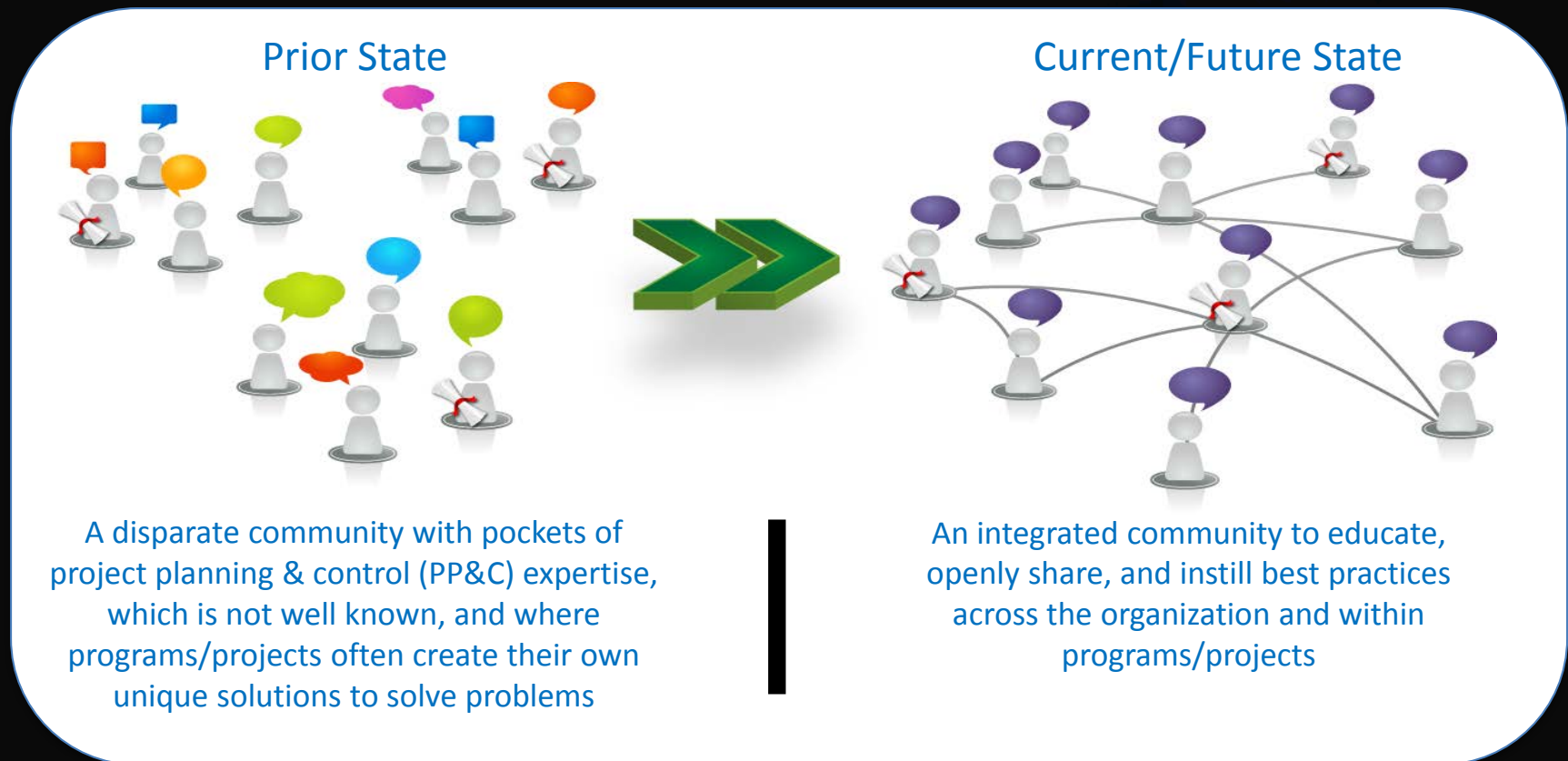
- **The first lesson in planning is that you can't plan for everything.**  
We encountered plenty of issues on MAVEN that required us to assess the impacts and move forward with Plan B. Surprises along the way:
  - Two instruments were delivered months late, during the year of launch
  - Application of a new material in a heritage system (MetGlas) and impacts in Integration and Testing. Must fully evaluate new materials and their application prior to use
  - Sequestration, with imposition of a travel cap in FY 2012 that threatened MAVEN's approach to conducting business
  - FY 2014 furlough beginning 7 weeks before scheduled launch and how we preserved MAVEN's full launch period
  - Removal of an instrument at the launch site for rework back at Goddard (the "Cannot Duplicate Problem" that surfaced again during launch preparations at KSC, and forced a late, tough decision)
  - Comet Siding Spring – truly an "unknown unknown" when we bid the mission in 2008. This comet was discovered in January 2013 and drove a significant amount of analysis and mitigation planning and implementation for the October 2014 encounter
- Find opportunities to team build at frequent intervals and schedule in lessons learned opportunities during every phase of development



# The Changing Environment for Projects and the Business Change Initiative

# Leveraging Our Project Management Skills

## Changing Project Planning & Control Environment



*Our vision/**reality** is increased collaboration with programs/projects consistently applying best practices and actions to foster cost-effective and on-time delivery for all missions*

# Significant External Reports and Findings Related to PP&C



Over 30 U.S. General Accounting Office and NASA Inspector General reports from 2009 onward identified more than 300 recommendations in the areas of scheduling, management, and training.



## GAO and NASA IG Reports from 2009 to 2016

<b>GAO-09-436T</b>	Projects Need More Disciplined Oversight and Management to Address Key Challenges	<b>GAO-15-006</b>	GEOSTATIONARY WEATHER SATELLITES Launch Date Nears, but Remaining Schedule Risks Need to be Addressed
<b>GAO-09-306SP, GAO-10-227SP, and GAO-11-239SP</b>	Assessments of Selected Large-Scale Projects	<b>GAO-15-100</b>	James Webb Space Telescope: Project Facing Increased Schedule Risk with Significant Work Remaining
<b>GAO-10-387T</b>	NASA Key Management and Program Challenges	<b>GAO-16-309SP</b>	Assessments of Major Projects
<b>GAO-11-364R</b>	Additional Cost Transparency and Design Criteria Needed for NASA Projects	<b>GAO-16-461T</b>	Preliminary Observations on Major Acquisition Projects and Management Challenges
<b>GAO-11-552R</b>	NASA Data Issues and Compliance	<b>GAO-16-688SU</b>	NASA's Needs to Improve Controls over High Impact Systems
<b>GAO-11-945T</b>	Polar Satellites: Agencies Need to Address Potential Gaps in Weather and Climate Data Coverage	<b>GAO-17-303SP, 100790</b>	NASA: Assessment of Major Projects
<b>GAO-11-672</b>	Acquisition Planning: Opportunities to Build Strong Foundations for Better Services Contracts	<b>IG-12-012</b>	Review of NASA's Lessons Learned Information System
<b>GAO-11-404</b>	Space and Missile Defense Acquisitions: Periodic Assessment Needed to Correct Parts Quality Problems in Major Programs	<b>IG-12-021</b>	NASA's Challenges to Meeting Cost, Schedule, and Performance Goals
<b>GAO-12-604</b>	Polar Orbiting Environmental Satellites: Changing Requirements, Technical Issues, and Looming Data Gaps Require Focused Attention	<b>IG-13-008</b>	NASA's Efforts to Reduce Unneeded Infrastructure and Facilities
<b>GAO-12-576</b>	Geostationary Weather Satellites: Design Progress Made, but Schedule Uncertainty Needs to be Addressed	<b>IG-14-018</b>	Space Communications and Navigation: NASA's Management of the Space Network
<b>GAO-12-207SP, GAO-14-338SP, GAO-15-309SP, GAO-15-320SP</b>	Assessments of Selected Large-Scale Projects	<b>IG-14-020</b>	NASA's Use of Space Act Agreements
<b>GAO-13-4</b>	James Webb Space Telescope: Actions Needed to Improve Cost Estimate and Oversight of Test and Integration	<b>IG-15-007</b>	Audit of the Near Earth Network
<b>GAO-13-22</b>	Earned Value Management Implementation across Major Spaceflight Projects Is Uneven	<b>IG-15-013</b>	NASA's Management of the Deep Space Network
		<b>IG-15-024</b>	Audit of NASA's Joint Cost and Schedule Confidence Level Process
		<b>IG-16-004</b>	NASA's Efforts to Manage Technical Capabilities - TCAT
		<b>IG-16-005</b>	NASA's Parts Quality Control Process
		<b>IG-16-008</b>	NASA's Efforts to Management Its Space Technology Portfolio
		<b>IG-16-014</b>	NASA's Management of the Near Earth Network
		<b>NA</b>	NASA IG Semiannual Report: April 1-September 30, 2012
		<b>NA</b>	ASK: Government Brief, GAO NASA Reviews
		<b>NA</b>	Geostationary Weather Satellites: Recommendations for Executive Action

# Goddard's Response to Challenges using the Business Change Initiative



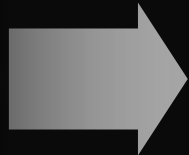
## *Environmental Challenges*

Rising costs, schedule delays, and disparate processes

Increasing budget constraints; perceptions of NASA and Center challenges

Possible retirement wave impacting knowledge capture and practices; need to ensure optimally-trained staff and sharing of best PP&C practices

Increasing external reviews and data requests



## *Our Response – BCI*

Comprehensive evaluation of best practices and management, communication and information sharing mechanisms intended to improve cost, schedule and overall performance across programs and projects



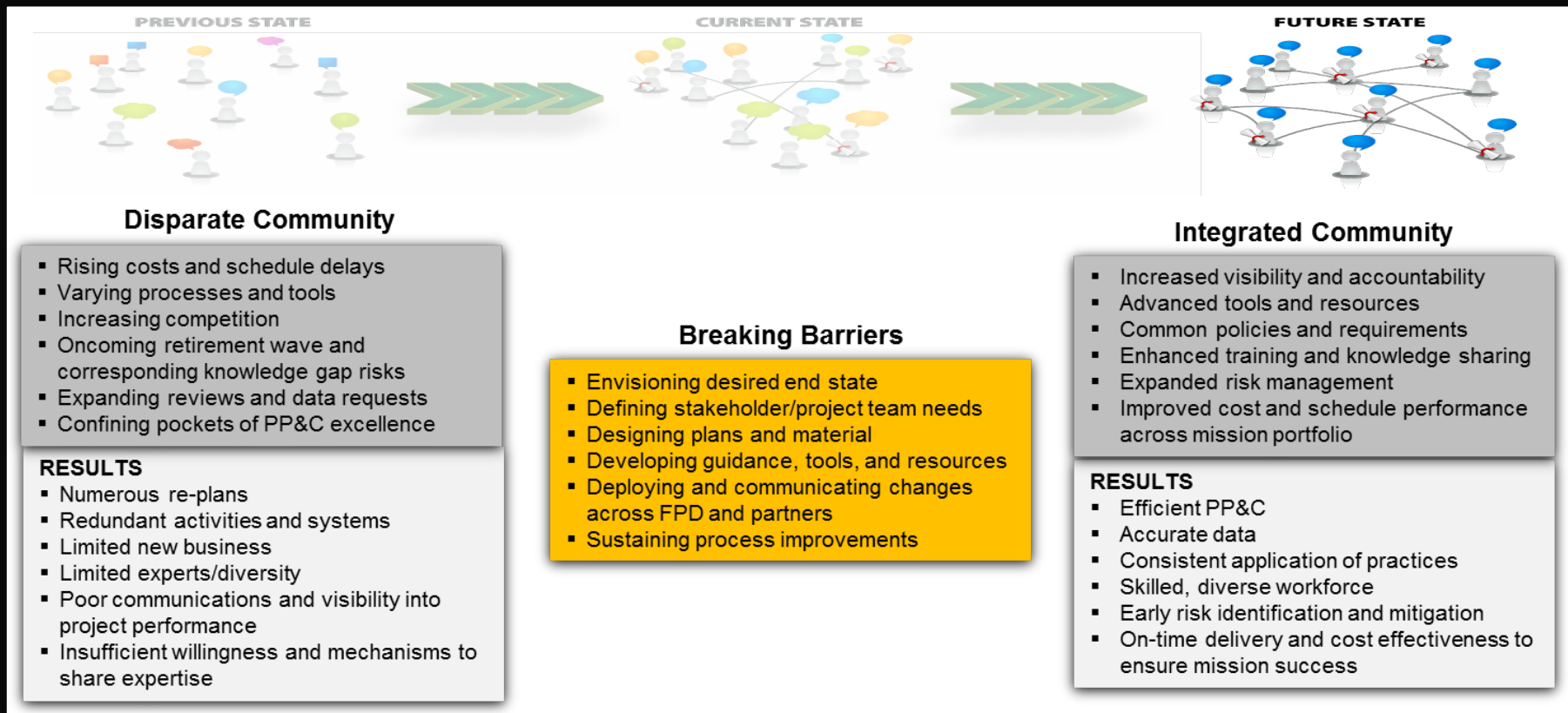
## *Outcomes*

- ✓ Improved knowledge base and sharing
- ✓ Increased use of best practices
- ✓ Reduced duplicative workflows
- ✓ Improved decision making
- ✓ More commonality in approaches and tools
- ✓ Optimized resources
- ✓ Improved project performance

# Business Change Initiative and PP&C Evaluation



The BCI comprehensively evaluated Goddard's PP&C, as well as programmatic communication and information sharing mechanisms to improve cost, schedule, and overall performance across the Flight Projects portfolio



# Scalability for Project Assistance & Compliance

## Incremental approach to ensure lasting change



### Lifecycle

Survey and assess complete program/project portfolio to understand similarities and differences



### Applicability

Identify valid needs for each grouping of “like” programs/projects to balance conditions for feasibility and adoption



### Compliance

Provide tools, templates, guidance, and resources to facilitate fulfillment of requirements for all applicable groups

*Prior to deployment, each change is developed with consideration of the affect on and significance to the GSFC project portfolio.*

*In many cases, various projects will be piloted to measure ability to adopt new practices, and tools and resources are developed from the feedback received to assist in acceptance.*



# Schedule Management Guidance, Tools, and Resources

## Procedural Guidelines

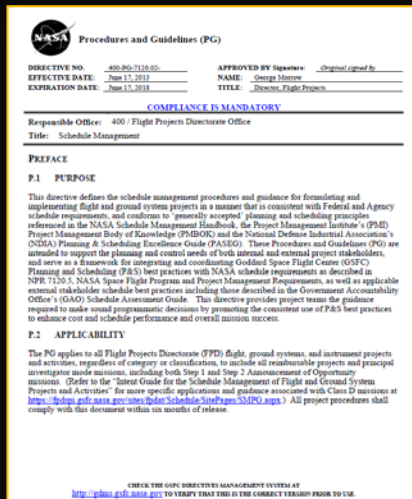
The PG establishes GSFC requirements for Schedule Management Plans, Integrated Master Schedules, Baseline Schedule Management, and Schedule Performance Analysis and Reporting

## Best Practice Instructions

Thirty-one BPIs were developed based on GSFC successes, as well as practices identified from other Centers, industry, and other agencies

## P&S Knowledge Network

The network is a SharePoint portal that houses the 31 BPIs and PG, as well as links to helpful aids, tools, templates, and resources



Document Schedule Requirements in Project Schedule Mgmt Plan	Develop In-House Subsystem Schedules Using PDL Checklist	Identify and Control Giver/Receiver Milestones	Design the Project Schedule Book	Assess Schedule Efficiency Along the Critical Path	Prepare an IMS Data Requirements Document
Assign a Lead Planner/Scheduler to the Project	Create an IMS Database in MS Project	Plan the Project Schedule Margin	Report the Critical Path for MSR	Report Project Control Milestone Performance and Forecast	Resource/Cost Load the Project IMS
Organize Project Schedule, Planning & Analysis Room	Estimate Realistic Activity Durations	Establish and Control the Schedule Baseline	Perform a Schedule Risk Analysis and Report Results	Report Total Slack Changes and Trends	Archive the Project IMS
Plan a Successful Schedule Summit	Document the Schedule Basis of Estimate	Implement a Schedule Control Board	Assess Baseline Schedule Performance with the BEI	Report Schedule Margin-to-Launch Trend	Assess Current Performance with the Monthly Hit/Miss Index
Develop the Project-Level Integrated Master Schedule (IMS)	Verify Schedule Integrity with Schedule Health Checks	Status and Update the Project IMS	Assess Current Schedule Performance with the CEI	Prepare and Update the MSR Critical Milestone Schedule	Reporting Summary Status with the Schedule Scorecard



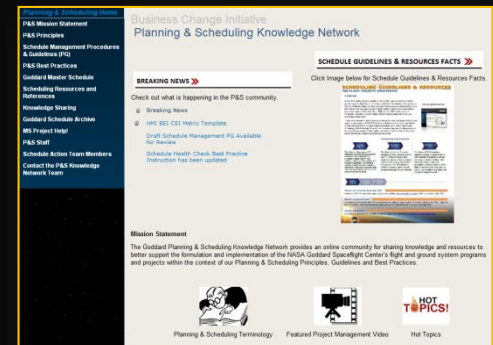
Required



Recommended



As Needed



# Best Practice Instruction – Conduct a Schedule Peer Review

## Schedule Peer Review Check List

1. Assign a Peer Review Chair
2. Select between two-to-four Peer Review members for the review board
3. Prepare a Peer Review Plan and deliver it to the project planner/scheduler, D/PMR and Deputy Project Manager. The Peer Review Plan can be an e-mail outlining:
  - a. Purpose of the Peer Review
  - b. Peer Review Members and current assignments
  - c. Estimated number of hours for Peer Review preparation, meetings and findings/recommendations preparation (if the review is funded by the project)
  - d. Data products requested in advance of the review
  - e. Date of review meeting (coordinated with the project)
  - f. Due date for out-briefing report to the project team – a face-to-face meeting to discuss the findings is preferred over a formal written report
4. Receive data products for review by the Peer Review members:
  - a. Project IMS
  - b. Supporting contractor / partner IMSs
  - c. Givers/Receivers List (if available)
  - d. Schedule Management Plan
  - e. Results of schedule risk analysis, health checks, Standing Review Board Programmatic Assessment Group findings, Government Accountability Office schedule audits, etc.
  - f. Work Breakdown Structure and dictionary
  - g. Project Plan (if available)
  - h. Project risk register
  - i. List of potential project descope (if available)
  - j. Most recent Monthly Status Review
5. A kick-off meeting / project briefing is recommended to acquaint the Peer Review members with the project background and schedule objectives
6. The Peer Review team members review the IMS and other data products
7. The Peer Review Chair requests additional data or clarifications from the project if needed
8. The Peer Review team should meet and discuss their initial individual findings and conduct ongoing meetings to integrate their findings and recommendations
9. Chair prepares Peer Review briefing including findings and recommendations
10. Peer Review findings and recommendations briefing charts are delivered to the project team 2-3 days before the briefing
11. The goal is to conduct the Peer Review briefing of findings and recommendations with the project team no later than three weeks after the kick-off meeting with the project

**Objective:** To expand knowledge sharing across projects and increase consistency in use of practices in developing quality Integrated Master Schedules

- Aids in evaluating a project's Integrated Master Schedule and associated schedule management processes
- Leverages the cadre of experts around Center for support/skills
- Supports interaction and exchange of tips and lessons
- Serves as a quality assurance review
- Employed to maintain standards of quality, improve performance, and provide credibility in terms of the Integrated Master Schedule

## LCRD Payload Schedule Peer Review Findings and Recommendations

January 25, 2013

Walt Majerowicz  
Jim Perry  
Lynn Wyatt

# Earned Value Management Focus

**Objective:** Increase EVM use and consistency for better tracking through improvements in various elements (tools, process, policy, training, and reporting)

## POLICY

- Provide Center response to NASA Headquarters requirements
- Prepare internal guidance for projects to navigate policy and approach

## COMPLIANCE

- Integrated Baseline Reviews/ Surveillance Reviews
- Key Decision Point reviews
- Contractor reviews

## TOOLS

- Develop and implement tool training
- Generate and install hardware and software requirements

## Earned Value Management System

## REPORTING

- Improve published reporting requirements
- Update monthly status reviews
- Create reporting users guide

## TRAINING

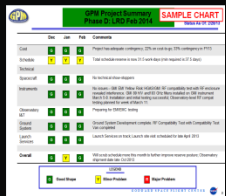
- Identify available training
- Identify training needs of workforce
- Tailor EVM training to projects life cycle and workforce

# BCI Accomplishments



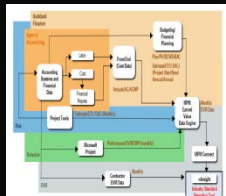
## **SCHEDULING – CONSISTENTLY DEVELOP, ANALYZE, AND EVALUATE PROJECT PROGRESS**

- ✓ Developed and deployed principle guidelines on Schedule Management
- ✓ Identified and created 30+ planning and scheduling best practice instructions
- ✓ Built a Planning and Scheduling Knowledge Network (via SharePoint)
- ✓ Coordinated collection for development of a project portfolio integrated management system



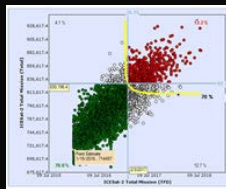
## **MANAGEMENT REPORTING – REFINE REPORTING TO MINIMIZE REDUNDANCY AND ADD TRANSPARENCY**

- ✓ Revised monthly status review guidance
- ✓ Streamlined the collection and reporting of top 10 issues report for programs and projects



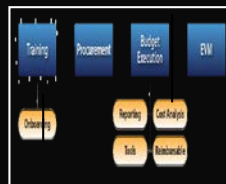
## **EVM – ADVANCE PERFORMANCE MANAGEMENT ANALYSIS AND EXECUTION**

- ✓ Assessed and defined As-Is EVM System Architecture
- ✓ Designed an EVM Training Curriculum Concept Document
- ✓ Coordinated and distributed EVM templates for project performance reporting
- ✓ Streamlined the acquisition process for EVM software



## **COST ESTIMATING – STANDARDIZE AND IMPROVE TECHNIQUES AND DOCUMENTATION OF COST ESTIMATING PROCESSES**

- ✓ Employed a reliable framework for conducting Joint Confidence Level model assessments
- ✓ Wrote and released a parametric cost estimation handbook/guide



## **KNOWLEDGE MANAGEMENT – IMPROVE KNOWLEDGE AND TRAINING AND AID IN TRANSFER OF DEPLOYMENTS**

- ✓ Re-constituted a forum to share learning, knowledge among community
- ✓ Designed curriculum and helped train to assist in successful execution of EVM
- ✓ Developed a tool kit and assessment tool for PP&C practitioners to develop skills
- ✓ Extended training on Budget Execution, Planning and Scheduling

# Provide Resources to Enable PP&C

## Tools

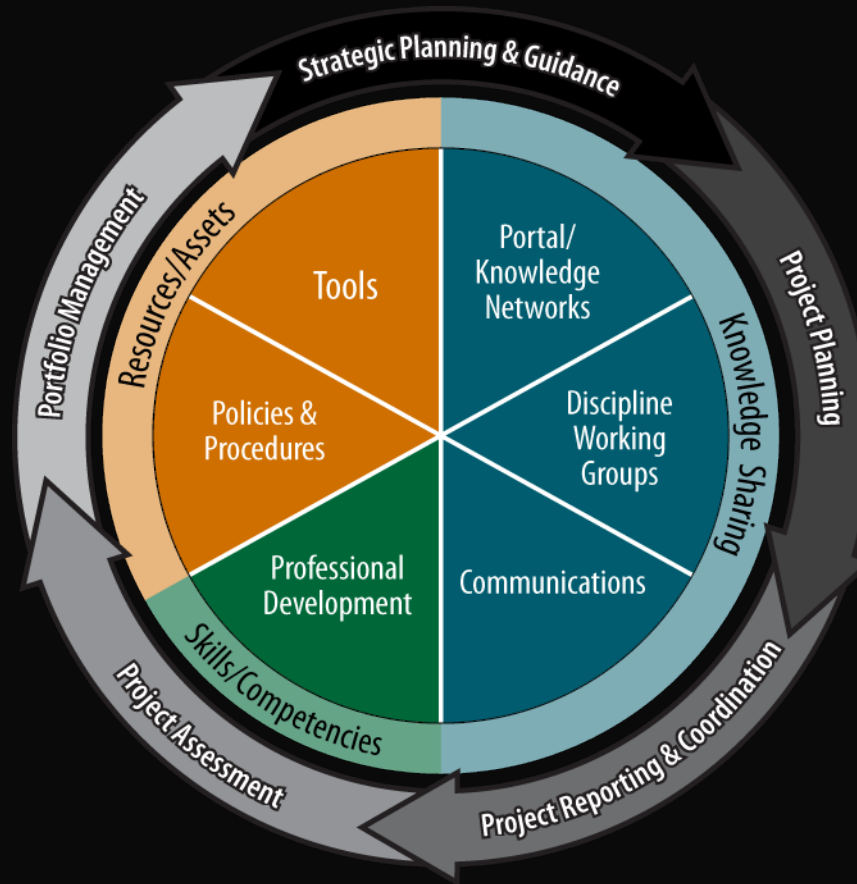
- Schedule Assist Team
- FPD Portfolio Database
- Portfolio Master Schedule
- Enterprise Licenses
- Goddard Schedule Analysis Tool
- Reporting Templates
- Journal Voucher Tool

## Policies & Procedures

- Best Practice Instructions
- Procedural Guidelines
- Discipline Handbooks

## Professional Development

- Flight Projects Development Program
- FPD SATERN Courses
- Development Dialogs
- Curriculum Guides



## Communications

- Senior Strategy Meetings
- Supervisory Meetings
- All-Hands
- Pause and Learns
- Masters Forums

## Discipline Working Groups

- Planning & Scheduling Lunch and Learns
- Earned Value Roundtables
- K-MAP Workshops
- Combined Resource Forums

## Portal/Knowledge Networks

- Integrated Performance Management
- Planning & Scheduling
- Cost Estimating/Management
- Management Reporting/Analysis
- Business Training & Tools



# Expand Knowledge Sharing Capabilities

## SharePoint Knowledge Network Toolkits

sdspi.gsfc.nasa.gov/sites/400/400fpdoffice/FPD/FPDPPC/SitePages/Schedule%20Network\_Detail.aspx

FPD Program Planning and Control Network > Schedule Network Detail

Home

What is PP&C

PP&C Toolkit

PP&C Process Improvement

PP&C Studies

FPD Business Process Reengineering Resource Log

### SCHEDULE

PP&C KNOWLEDGE NETWORK

EROSION DESIGN DEVELOP DEPLOY SUSTAIN & REFIN

Policy Procedures Guidance Tools Templates Training

#### Policy

- P&S Principles
- GPR for Schedule Margins
- NASA Scheduling Handbook
- NPR 7120.6

#### Procedures

- Schedule Management Procedures
- Schedule Management Intent Guide

#### Guidance

- BPI Library
- DCMA Assessment Criteria
- GSFC Procurement Lead Times
- GSFC Schedule Check List
- P&S Terminology
- Featured P&S Videos
- P&S 10 Best Practices

Control No.	Best Practice Title
PS 403.01	Document Schedule Requirements in the Project Schedule + Best Practice Instruction   + PDF of Best Practice Instruction + Implementation Guidance + Examples
PS 403.02	Assign a Lead Planner/Scheduler to the Project + Best Practice Instruction   + PDF of Best Practice Instruction
PS 403.03	Schedule Planning & Analysis Room (SPAR) + Best Practice Instruction   + PDF of Best Practice Instruction + Example SPAR Layout
PS 403.04	Plan a Successful Schedule Summit + Best Practice Instruction   + PDF of Best Practice Instruction + Example Schedule Summit Agenda
PS 403.05	Develop the Project-Level Integrated Master Schedule + Best Practice Instruction   + PDF of Best Practice Instruction + Implementation Guidance
PS 403.06	Develop In-House Subsystem Schedules Using the Schedule + Best Practice Instruction   + PDF of Best Practice Instruction + Schedule Checklist
PS 403.07	Create an Integrated Master Schedule Data + Best Practice Instruction   + PDF of Best Practice Instruction
PS 403.08	Estimate Realistic Activity Durations + Best Practice Instruction   + PDF of Best Practice Instruction
PS 403.09	Document the Schedule Basis of Estimate + Best Practice Instruction   + PDF of Best Practice Instruction + GSFC Schedule BOE Checklist + GSFC Schedule BOE Template
PS 403.10	Verify Schedule Integrity with Schedule Health Checks + Best Practice Instruction   + PDF of Best Practice Instruction + Implementation Guidance + GAO Schedule Best Practice Score Sheet + Examples
PS 403.11	Identify and Control Giver/Receiver Milestones + Best Practice Instruction   + PDF of Best Practice Instruction

Updated March 10, 2013

### GSFC Flight Projects Directorate P&S Best Practices

**Best Practice Title:** Verify Schedule Integrity with Schedule Health Checks

**Control Number:** PS403.10

**Description:** This best practice is intended to measure the credibility of the project-level and contractor Integrated Master Schedules (IMS) relative to NASA Schedule Test and Assessment Tool (STAT) criteria, NASA Schedule Management Handbook processes and practices, Government Accountability Office (GAO) Schedule Best Practices and Defense Contract Management Agency (DCMA) 14 Point Assessment criteria.

**Purpose & Benefits:** The primary purpose of the schedule health check is to assure that the IMS contains credible schedule data addressing the total scope of work at a level of detail sufficient for discrete progress measurement, management visibility, critical path identification & control and the capability to accurately plan necessary resources when needed to accomplish the work.

GAO Best Schedule Practice and Criteria	Compliance Score	Comments
<b>BP# 1: Capture All Activities</b>	Green	
a. Schedule reflects WBS	Green	
b. Schedule reflects all effort		
c. IMS includes all phases for entire duration of project		
d. IMS can be rolled up from detailed to intermediate to summary schedules	Green	
e. Detailed schedules include all activities that must be performed to complete the work, including GFE, deliverables and services	Yellow	GFE to be added to IMS in next update cycle

#### Schedule Health Check

Overall Project Health Status Indicator: G G

Project Name: Master 28 June 2013 Final

Schedule Status		Current	Previous	Change (C-P)
Description		2/5/2009	2/5/2009	
Current Start (Notes: earliest activity Early Start Date)		10/31/2019	10/31/2019	0 0.0%
Current Finish (Notes: latest activity Early Finish Date)		1586	1605	-19 -1.2%
Approximate Remaining Work Days		Y	Y	
Is this schedule externally linked to other schedules?		6/28/2013	5/31/2013	28
Status Date				

Task and Milestone Count (Note: These counts exclude summary tasks)		Count	% of Total	Count	% of Total	Change (C-P)
Description		24511		23813		698
Total Tasks and Milestones		10904	44.5%	10053	42.2%	851 2.3%
Completed Tasks and Milestones		13607	55.5%	13760	57.8%	-153 -2.3%

Logic (Note: These counts exclude summary and started/completed tasks)		Count	% of Total	Count	% of Total	Change (C-P)
Description		218	1.6%	230	1.7%	-12 -0.1%
Tasks and Milestones Without Predecessors		219	1.6%	222	1.6%	-3 0.0%
Tasks and Milestones Without Successors						

# Completed Changes...

Approximately 100 changes were deployed from 2012–2014 spanning schedule, cost, earned value, risk, and configuration management, as well as project coordination, reporting, performance analysis, and employee education

## BCI Accomplishments Log

Purpose: Summarizes the Business Change Initiative's major accomplishments to date. Each change is associated with a particular Action Team or discipline area, and includes a description so that those less familiar with the initiative can become better acquainted with each achievement. Please visit the BCI Phases for a better understanding of Phase I, II, and III.

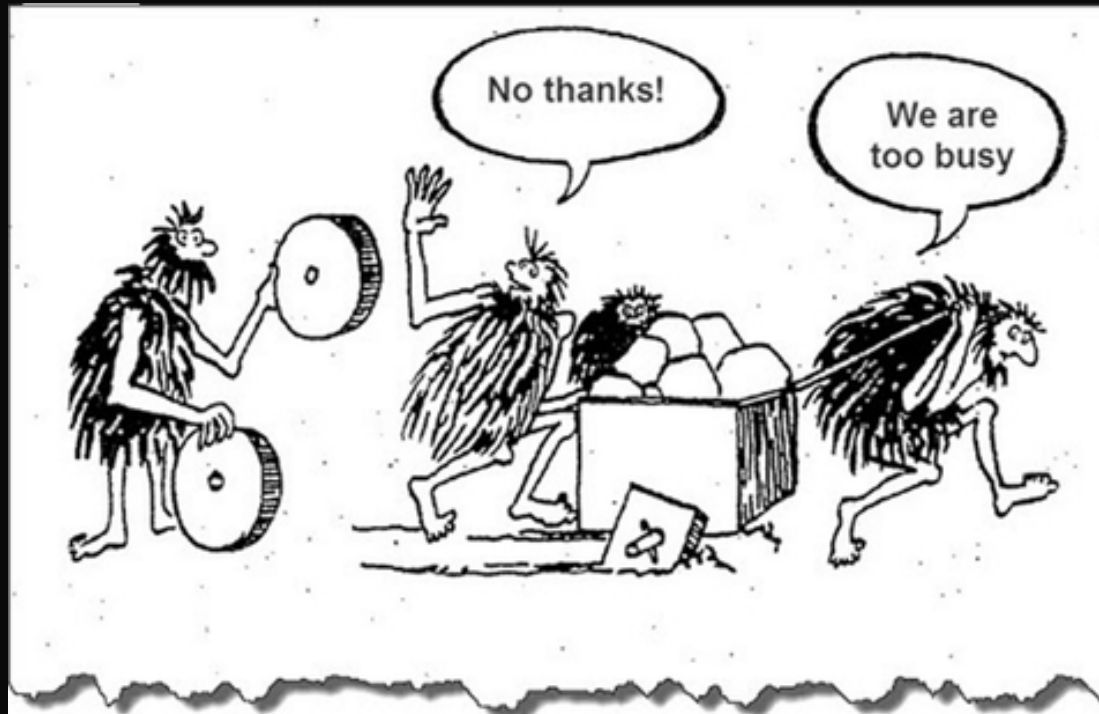
Title	Released
Developed Instructional Content for CFO Foundations Course	Q3 2012
Released GSFC Joint Confidence Level Handbook	Q4 2013
Identified Code 400 Points of Contact to Coordinate Subject Matter Expertise	Q3 2014
Developed Independent Analysis Approach	Q4 2013 (ongoing)
Streamlined EVM Software Acquisition Process through Deployment of MPM 3.4	Q3 2013
Developed Robust Threat Profiles	Q4 2013 (ongoing)
Created Document Management Guidance Library	Q1 2014
Produced Performance Management Reference Card	Q2 2014
Developed Standard Joint Confidence Level Approach	Q4 2013
Piloted Electronic Control Account Manager Notebook	Q3 2014
Established Schedule Assist/Peer Review Team	Q4 2013
Developed Goddard Schedule Analysis Tool	Q1 2014
Created and maintained Goddard Master Schedule	Q2 2012 (ongoing)
Reconstituted the Combined Resources Forum for FPD	Q4 2011
Created EVM Training Curriculum Concept Document	Q2 2013
Streamlined Reporting of Center's Top 10 Issues	Q2 2013
Created and maintained Goddard Schedule Archive	Q1 2013 (ongoing)
Created Planning & Scheduling Best Practice Instructions	Q3 2013
Released Schedule Management Procedural Guidelines	Q3 2013
Consolidated PIP Repository	Q4 2013
Developed GSFC EVM Tool Architecture V.1	Q3 2013
Added MS Project Help Feature	Q1 2013
Developed GSFC EVM Requirements Matrix	Q4 2012
Released EVM Survey	
Established 10 Planning & Scheduling Principles	
Launched Planning and Scheduling Knowledge Network	
Formalized Schedule Performance Metrics into Continuous Project Coordination	
Updated Monthly Reporting Requirements	
Developed EVM Project Control Account Manager Training	
Developed Templates for Project Performance	

...and Continuously Optimizing



# Principles of Change

# A Continuing Need for a Collaborative Network



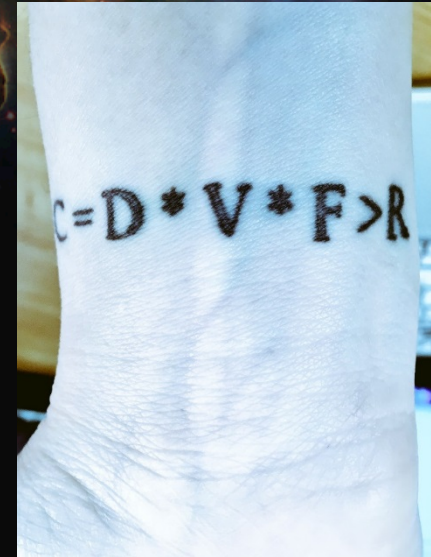
# Formula for Change

$$C = D * V * F > R$$

D = Dissatisfaction with how things are now

V = Vision of what is possible

F = First, concrete steps that can be taken towards the vision



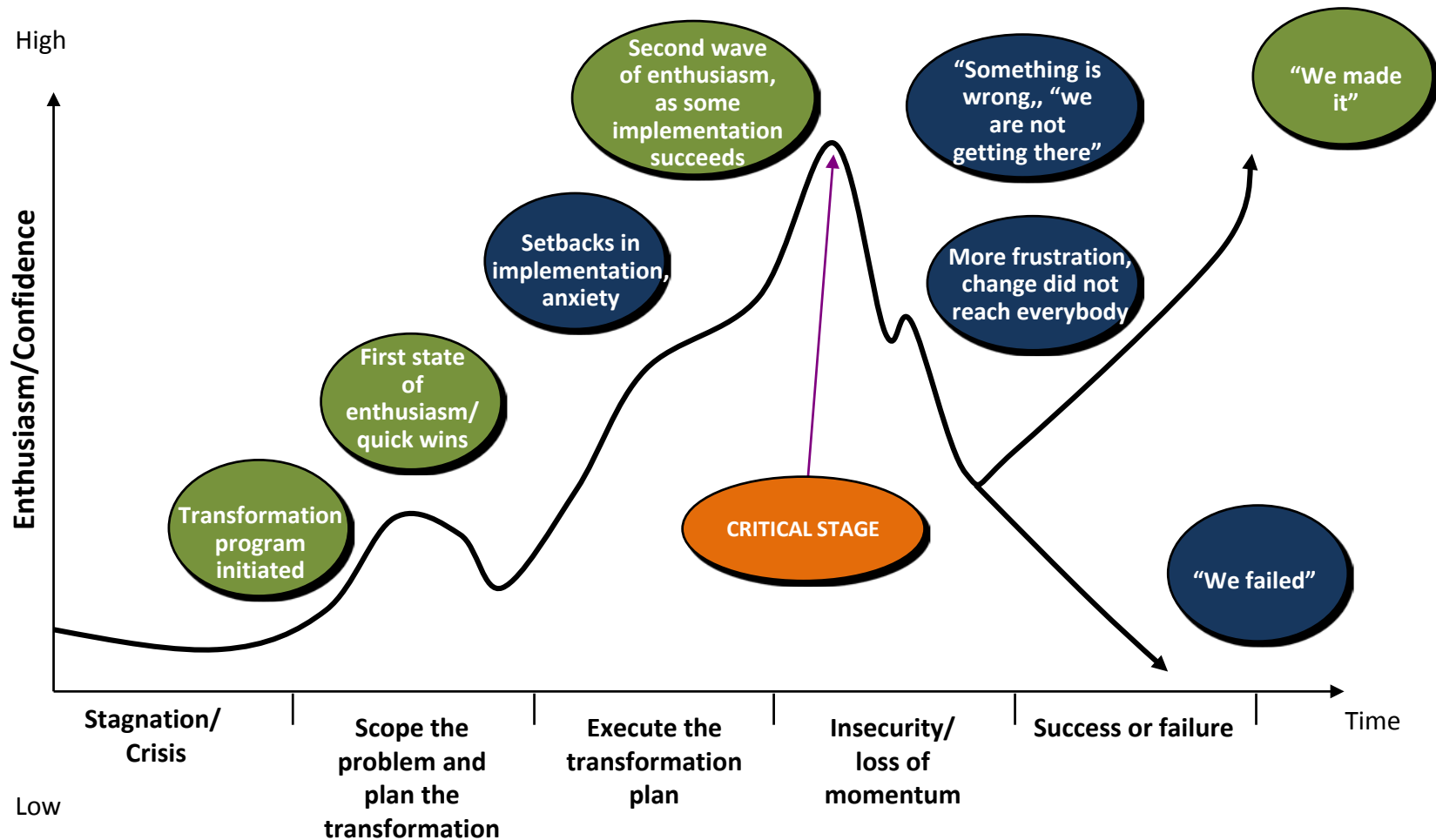
If the product of these three factors [**Dissatisfaction, Vision, and First**]

is greater than **Resistance** [R],

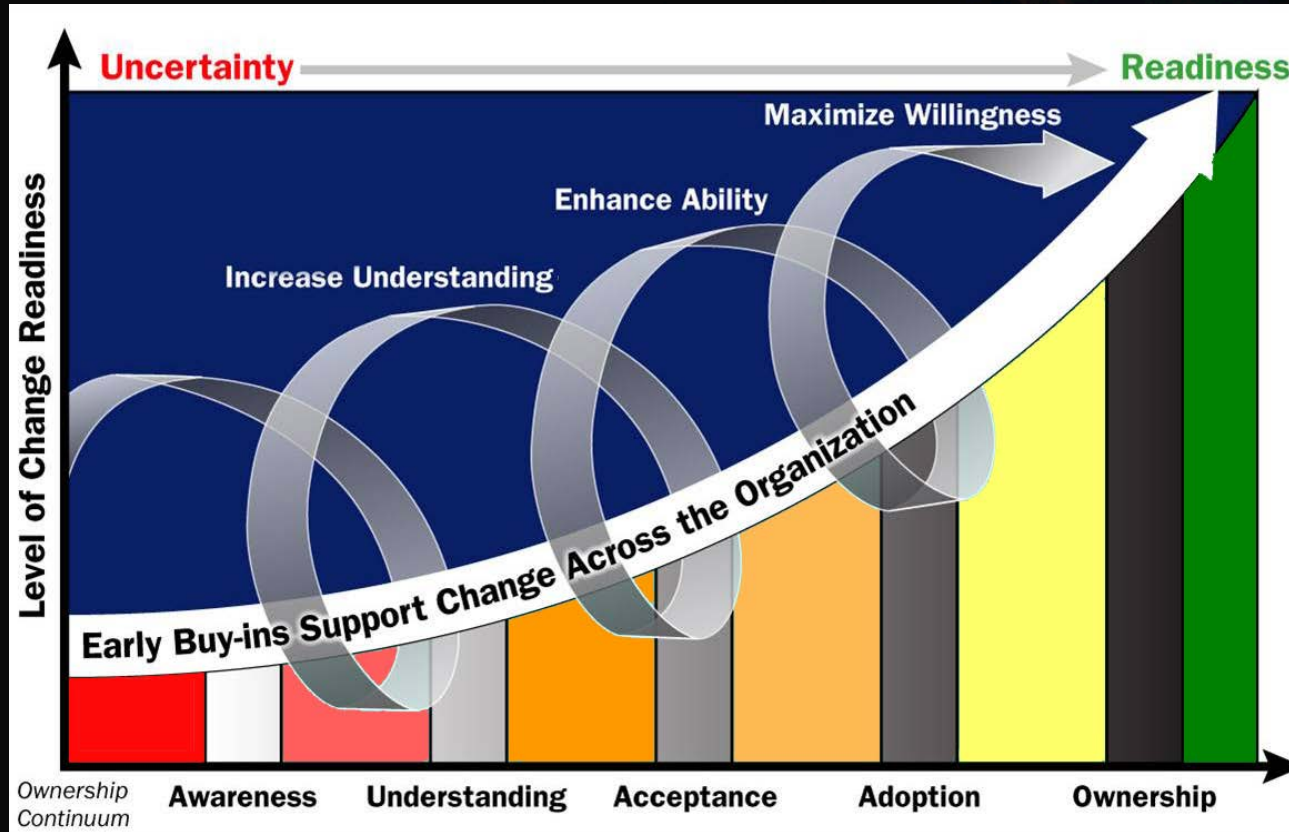
this then equals **Change** [C]

Never be afraid of change! Own it, expect it, embrace it, and lead others from any position!!!

# Danger Points in any Change Initiative



# Building Ownership is Key to Successful Implementation



- ▶ Organizations don't change, people do. Moving people up the continuum is key to changing behaviors required for success
- ▶ Change management moves stakeholders through these stages to ensure progress in implementing new approaches

# Those Facing Change can be Organized into Three Groups



**The Advocates**—These are people who recognize a good idea and embrace new approaches that may help them do their jobs

- *Get as many of these people on your side. They become the “town-criers” who will ultimately help the change be embraced*

**The Uninformed or Indifferent**—This group may be either unaware of the goals or unsure if the change will ultimately help them

- *You need to show the value of the new approaches to this group ASAP. If they like what they hear, they will become advocates. If you are unable to show value, this group may join the group below*

**The Naysayers**—This group often resists any change. Perhaps they have been successful for a long time and see no reason for change. This group is often sarcastic and/or skeptical of any communications

- *Minimize this group’s effectiveness. You can’t completely ignore them (think termites in wood), but you can’t devote too much time to them. Always address them or show interest, but don’t get bogged down. Limit their damage while keeping others from joining*

# Significant External Reports and Findings Related to PP&C



Over 30 U.S. General Accounting Office and NASA Inspector General reports from 2009 onward identified more than 300 recommendations in the areas of scheduling, management, and training.



## GAO and NASA IG Reports from 2009 to 2016

<i>GAO-09-436T</i> Projects Need More Disciplined Oversight and Management to Address Key Challenges	<i>GAO-15-006</i> GEOSTATIONARY WEATHER SATELLITES Launch Date Nears, but Remaining Schedule Risks Need to be Addressed
<i>GAO-09-306SP, GAO-10-227SP, and GAO-11-239SP</i> Assessments of Selected Large-Scale Projects	<i>GAO-15-100</i> James Webb Space Telescope: Project Facing Increased Schedule Risk with Significant Work Remaining
<i>GAO-10-387T</i> NASA Key Management and Program Challenges	<i>GAO-16-309SP</i> Assessments of Major Projects
<i>GAO-11-364R</i> Additional Cost Transparency and Design Criteria Needed for NASA Projects	<i>GAO-16-461T</i> Preliminary Observations on Major Acquisition Projects and Management Challenges
<i>GAO-11-552R</i> NASA Data Issues and Compliance	<i>GAO-16-688SU</i> NASA's Needs to Improve Controls over High Impact Systems
<i>GAO-11-945T</i> Polar Satellites: Agencies Need to Address Potential Gaps in Weather and	<b><i>GAO-17-303SP, 100790</i> NASA: Assessment of Major Projects</b>
<b><i>GAO – NASA's Systems Overview/Quick Look Book (100790): On 3/31/2017, GAO issued the draft report (two documents) for Agency review and comment entitled "NASA: Assessment of Major Projects" (GAO-17-303SP; 100790). The objectives of the audit were to assess: 1) the cost and schedule performance of NASA's portfolio of major projects; 2) the maturity of technologies and stability of project designs at key points in the development process; and 3) NASA's progress in implementing initiatives to manage acquisition risk and potential challenges for project management, execution and oversight. <u>GAO found that cost and schedule performance of NASA's major projects has continued to improve, but this trend may be difficult to sustain.</u> GAO makes no recommendations to NASA in the draft report. NASA's response to the draft report is due 4/28/2017.</i></b>	
<i>IG-12-012</i> Review of NASA's Lessons Learned Information System	<i>IG-12-021</i> NASA's Challenges to Meeting Cost, Schedule, and Performance Goals
<i>IG-12-021</i> NASA's Challenges to Meeting Cost, Schedule, and Performance Goals	<i>IG-13-008</i> NASA's Efforts to Reduce Unneeded Infrastructure and Facilities
<i>IG-13-008</i> NASA's Efforts to Reduce Unneeded Infrastructure and Facilities	<i>IG-14-018</i> Space Communications and Navigation: NASA's Management of the Space Network
<i>IG-14-018</i> Space Communications and Navigation: NASA's Management of the Space Network	<i>IG-14-020</i> NASA's Use of Space Act Agreements
<i>IG-14-020</i> NASA's Use of Space Act Agreements	<i>IG-15-007</i> Audit of the Near Earth Network
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<i>IG-15-024</i> Audit of NASA's Joint Cost and Schedule Confidence Level Process	<i>IG-16-004</i> NASA's Efforts to Manage Technical Capabilities - TCAT
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<i>NA</i> ASK: Government Brief, GAO NASA Reviews	<i>NA</i> Geostationary Weather Satellites: Recommendations for Executive Action



# A Few of My Favorite Management Adages

- How can you develop a compelling vision for an organization until you have a compelling vision for your own life – a better understanding of your own values, needs, expectations, hopes, and dreams?” -*Joseph Boyett*
- Follow the OODA (Observe-Orient-Decide-Act) loop - *Sun Tzu's Art of War*
- One doesn't discover new lands without losing sight of the shore for a very long time - *Andre Gide*
- Our doubts are traitors and make us lose the good we oft might gain by fearing to attempt - *Shakespeare*
- Some days you're the pigeon and some days you're the statue - *Shinn*
- Hard work is usually the easy work you didn't do when you were supposed to do it - *Shinn, which I probably stole from somewhere*





It is difficult to say what is  
impossible...  
for the *dream of yesterday*  
is the *hope of today*  
And the *reality of Tomorrow.*

- Robert H. Goddard (1882 - 1945)















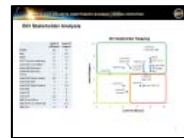



**Thank You!**

# Communication: The Key to Change Management



Communications tools are focused on stakeholder messaging and status updates during the BCI process, as well as ensuring awareness, understanding, and adoption of changes throughout the implementation process

<b>Communications Plan</b> Communication tools or activities to build awareness of the change's purpose and direction 	<b>Branding</b> Standardized look and feel that accompanies all materials 	<b>Overview Presentations</b> Briefings to build awareness among key internal and external stakeholders 	<b>Awareness Building Meetings</b> All hands meetings; best practices forums; practitioner trainings; shadowing; lunch and learns; monthly management meetings; EVM practitioners meetings; and Combined Resources Forum 
<b>Process for Action Teams</b> Reference guide for Action Team members 	<b>Action Team Summary of Activities</b> Overall progress made 	<b>Status Reports</b> Bi-weekly publication to share and archive overall progress 	<b>Q&amp;A Interviews</b> Focused on a key leader from one of the Action Teams to expand program visibility 
<b>Fact Sheets</b> Techniques, tools or processes that have been identified by as outstanding and replicable 	<b>Executive Notebooks</b> Compendium on the BCI to give leadership summary overviews and detailed information 	<b>Email Messaging</b> Issue-specific messages and updates that allow for ongoing corporate messaging 	<b>Website for External Audiences</b> <a href="http://fpd.gsfc.nasa.gov/bci-intro.html">http://fpd.gsfc.nasa.gov/bci-intro.html</a> 
<b>SharePoint Pages by Action Team</b> Internal website for Action Team reference 	<b>SharePoint Page as Knowledge Exchange Portal</b> Final documents, reports and recommendations for historical archive 	<b>Stakeholder Analysis</b> Key constituencies that can help advance or hinder changes to be implemented 	<b>Implementation Plan</b> Detailed planning document for each change to be implemented 

# Tips for Leading Change



ENGAGE WITH AND WIN OVER RESISTERS	RELAY THE MESSAGE	EMPOWER OTHERS TO TAKE ACTION	COMMUNICATE WITH CLARITY AND CONFIDENCE	BE VISIBLE AND BE APPRECIATIVE
Not all resistance is without merit — assess whether or not a resister has sound reasons or concerns for refusing to change	Share your belief in the positive impact of the change initiatives to your organization	Provide resources, development opportunities, coaching, and mentoring	Provide candid and ongoing feedback to the initiative team and leadership	Celebrate short-term wins and communicate those to larger audiences
Provide an opportunity for resisters to express their point of view — you will discover the barriers to the change effort	Express personal confidence that your change initiatives are the right direction for your organization	Delegate work so that others are involved and accountable, manage details	Respond openly to fears, realities, and rumors	Publicly recognize individuals who are making change happen
Constantly address “What’s in it for me?” — educate resisters about the change effort by listing the benefits of the change for your organization and for the individual	Ask, “What else can I/we do to achieve the desired outcomes?”	Encourage personnel to contribute to the resolution of issues that will arise	Identify what things are most painful about the change in an upfront “here’s how we will address it” manner	Emphasize that short-term wins are important but there is still much work to be done
Encourage a role for resisters — they are more likely to buy into the change rather than resist it if involved	Proactively take “ownership” of applicable change initiatives — be the change	Value input from every level	Communicate early, often, and in a variety of ways	Share lessons learned as a means of leveraging best practices — you are vital to setting the right climate for a successful change implementation

# Qualities and Attributes for Successful Project Management Positions (1 of 3)



## Planning, Organization, Implementation, and Control

- Possess a combination of professional experiences and personal qualities and attributes
- Possess a fairly common set of personal qualities and attributes which are actively sought in potential candidates:
- Possess positive attitude
  - Maintain “can-do” attitudes in the face of seemingly impossible obstacles
  - Always seek the best way forward from any setback
  - Never give up
  - Instill this attitude in team members
  - Are candid, open
- Possess strong leadership
  - Motivate others to achieve project goals
  - Instill positive attitude in others
  - Lead by example
  - Delegate authority and trust
  - Are people oriented
  - Possess high degree of integrity and honesty; word is bond
  - Communicate well at all levels

# Qualities and Attributes for Successful Project Management Positions (2 of 3)



Planning, Organization, Implementation, and Control

- Possess [technical] competence
  - Systems perspective: understanding how all technical disciplines function together
  - Demonstrated hands-on experience: functional management and lead engineer
  - Management perspective: understanding how business and management disciplines are integral to the project effectiveness
  - Ability to make informed decisions based on an understanding of various disciplines
  - Notional career progression might be: component engineer, subsystem engineer, systems engineer, observatory or instrument systems manager, deputy project manager  
[note – this works for almost any industry]



# Qualities and Attributes for Successful Project Management Positions (3 of 3)

## Planning, Organization, Implementation, and Control

- Possess strong decision-making skills
  - Make sound decisions without complete information
  - Understand when information is sufficient to make a decision based on expert opinions of risks and probabilities
  - Take responsibility for decisions
- Possess confidence
  - Be confident in ability to work through problems and accomplish goals
  - Be able to compromise, be flexible
  - Possess sense of humor
- Are goal focused
  - Capable of planning, motivating and directing
  - “Keeps an eye on the prize” despite a variety of distractions
  - Committed to getting the job done; hardworking, positive, enthusiastic